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Langley Research Center

Scientific and Technical Information Program Office

Scientific and Technical Aerospace Reports

STAR

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WHAT'S INSIDE

NASA STI Program ... in Profile

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- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

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The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at http://www.ntis.gov.

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The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at http://www.uspto.gov/patft/.

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Subject Divisions/Categories

Document citations are grouped by division and then by category, according to the *NASA Scope and Coverage Category Guide.*

Aeronautics

Astronautics

Chemistry and Materials

Engineering

Geosciences

Life Sciences

Mathematical and Computer Sciences

Physics

Social and Information Sciences

Space Sciences

Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also select either of the two indexes provided for linking to the corresponding document citation from *NASA Thesaurus* terms and personal author names.

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 41, DECEMBER 12, 2003

02
AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also *34 Fluid Mechanics and Thermodynamics*.

20030108377 Naval Postgraduate School, Monterey, CA
Compilation of Theses Abstracts
Dec. 2002; 108 pp.; In English
Report No.(s): AD-A417252; NPS-09-03-003; No Copyright; Avail: CASI; A06, Hardcopy

This publication contains unrestricted abstracts (unclassified and unrestricted distribution) of theses submitted for the degrees Aeronautical and Astronautical Engineer, Electrical Engineer, Mechanical Engineer, Master of Science, and Master of Arts for the December 2002 graduation. Classified and restricted distribution abstracts are listed on the NPS SIPRnet. This compilation of abstracts of theses is published in order that those interested in the fields represented may have an opportunity to become acquainted with the nature and substance of the student research that has been undertaken. Copies of theses are available for those wishing more detailed information.
DTIC
Theses; Abstracts

20030108631 Air Force Academy, CO
Winged Crusade: The Quest for American Aerospace Power
Oct. 2003; 78 pp.; In English
Report No.(s): AD-A417268; No Copyright; Avail: CASI; A05, Hardcopy

This bibliography lists a selected portion of the McDermott (Cadet) Library's holdings on the American experience of manned powered flight during the twentieth century. Excluded are newspaper articles, most pictorial works, works dealing with lighter-than-air flight and studies of rotorcraft.
DTIC
Bibliographies; Rotary Wing Aircraft

20030109134 Naval Postgraduate School, Monterey, CA
Upgrade of a LabVIEW Based Data Acquisition System for Wind Tunnel Test of a 1/10 Scale OH-6A Helicopter Fuselage
Lines, Philipp A.; Jun. 2003; 99 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417575; No Copyright; Avail: CASI; A05, Hardcopy

For over half a century the NPS Aerolab Low Speed Wind Tunnel located in Halligan Hall of the Naval Postgraduate school has served to provide students and facility with meaningful aerodynamic data for research and problem analysis. New data acquisition hardware was installed three years ago but never fully verified, and contained no integrated software program to collect data from the strain-gauge balance pedestal. Existing National Instruments based hardware for the NPS low-speed wind tunnel was reconfigured to obtain data from the strain-gauge pedestal. Additionally, a data acquisition software program was written in LabVIEW(C) to accommodate the hardware. The Virtual Instruments (VI) program collects and plots accurate data from all four strain gauges in real-time, producing non-dimensional force and moment coefficients. A research study on the performance of an OH-6A helicopter fuselage was conducted. NPS Aerolab wind tunnel tests consisted of drag, lift, and pitching moment measurements of the OH-6A along yaw and angle-of attack sweeps. The results of the NPS wind tunnel data were compared against testing conducted on a full-scale OH-6A helicopter in NASA Ames' 40 ft. by 80ft. wind tunnel, along

with the U.S. Army's Light Observation Helicopter (LOH) wind tunnel tests. Results of current testing substantiate the LabVIEW(C) code.
DTIC
Wind Tunnel Tests; Oh-6 Helicopter; Fuselages; Airframes; Pitching Moments

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in *09 Research and Support Facilities (Air)*. Air traffic control is covered in *04 Aircraft Communications and Navigation*. For related information see also *16 Space Transportation and Safety* and *85 Technology Utilization and Surface Transportation*.

20030108516 National Transportation Safety Board, Washington, DC, USA
Annual Review of Aircraft Accident Data. U.S. Air Carrier Operations Calendar Year 1998
Jan. 2002; 59 pp.; In English
Report No.(s): AD-A417219; NTSB/ARC-02/02; No Copyright; Avail: CASI; A04, Hardcopy

The 1998 Annual Review of Aircraft Accident Data for U.S. Air Carrier Operations presents a statistical compilation and review of accidents that occurred in 1998 involving aircraft operated by U.S. air carriers. In addition to providing accident statistics for 1998, the review also includes general economic indicators that may influence aircraft activity for 1998 and contextual accident data from several years preceding the reporting period.
DTIC
Civil Aviation; Aircraft Accidents

20030108902 Naval Postgraduate School, Monterey, CA
Study of Hydrogen As An Aircraft Fuel
Ciaravino, J. S.; Jun. 2003; 69 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417421; No Copyright; Avail: CASI; A04, Hardcopy

The conversion to hydrogen as a naval aviation fuel would allow for independence on fuel cost and supply, as hydrogen is globally accessible. The biggest obstacle to using hydrogen is its very low density, a property that even combined with hydrogen's high heat of combustion still results in very large fuel tanks. Liquid hydrogen (LH2) with its higher density would still require a larger volume than kerosene for the aircraft to achieve the same mission. Another problem with using LH2 is its cryogenic nature, a property that requires complicated fuel tanks and more careful fueling. A design study has been conducted for this report to determine the feasibility of using LH2. A Lockheed-Martin P-3 Orion configuration was modified to accommodate LH2 as its fuel, its mission parameters kept unchanged. It is concluded from this design study that using LH2 would significantly limit the amount of usable cabin space, as the fuel tank takes up 65% of the aircraft's internal volume. Despite the large LH2 tank weight of about l4,865lb, due to the low fuel weight the aircraft's takeoff gross weight is only ll3,646lb, about 80% of the current petroleum-fueled P-3. The total cost of LH2 as fuel is currently undetermined.
DTIC
Refueling; Hydrogen; Aircraft Fuels; Heat Of Combustion; Military Aviation

20030109091 Naval Postgraduate School, Monterey, CA
Visual Simulation of Night Vision Goggles In A Chromakeyed Augmented Virtual Environment
Beilstein, Del L.; Jun. 2003; 178 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417463; No Copyright; Avail: CASI; A09, Hardcopy

As data from the U.S. Army Safety Center supports, a large percentage of Army Aviation human error accidents occur during NVG flight. Despite this fact, there are very few simulation tools available to aviators at the unit level that aid them in learning or practicing NVG flight tasks. This thesis examines the potential for a Chromakeyed Augmented Virtual Environment (ChrAVE), consisting only of Commercial- Off-The- Shelf (COTS) hardware, to be used as an NVG flight training platform. It also examines whether or not physically- based light calculations are necessary to produce adequate visual representation of simulated NVG imagery. Twelve subjects performed simulated low-level NVG flight navigation tasks in the ChrAVE. Treatments included questionnaires, vision tests, variation of the physics-based component of the NVG imagery, and performance of an evaluation task that compares standard thresholds between day and NVG navigation. Analysis of data and subject feedback suggests that the ChrAVE has potential as an NVG flight training device, and that physically-based

calculations may not be necessary to achieve simulated NVG imagery that is adequate for training. The data also supports the existence of a substantial difference in the subjective evaluation standard between navigation performances based on flight condition.
DTIC
Night Vision; Goggles; Flight Simulation; Virtual Reality

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information see also *18 Spacecraft Design, Testing and Performance*; and *39 Structural Mechanics*. For land transportation vehicles see *85 Technology Utilization and Surface Transportation*.

20030108406 Naval War Coll., Newport, RI
Extending Operational Reach With Unmanned Systems
LeBouvier, Rand D.; May 16, 2003; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417223; No Copyright; Avail: CASI; A03, Hardcopy

While unmanned vehicles promise a multitude of operational capabilities and might be seen as a Revolution in Military Affairs, the focus of this discussion is primarily upon understanding their most constructive applications in support of the operational commander. The relative novelty of unmanned systems offers an opportunity for warfighters to provide their input during concept development to guarantee that systems accommodate their operational requirements. With caution and foresight, the ultimate potential of unmanned systems may be realized. Now that researchers are beginning to understand their capabilities, unmanned systems are quickly becoming indispensable. It is essential to develop a commensurate understanding of the impact of this resource, particularly upon operational warfare. Perhaps the greatest contribution that unmanned vehicles can make is as an extension of operational reach as an adjunct to, not a replacement for, human decision making. Unmanned systems allow the operational commander the ability to extend his or her reach in terms of space, time, and force. As to their proper status, unmanned vehicles are tools. How the military uses these tools is more relevant than the kinds of technologies they proffer. Unmanned systems are already capable of giving us more information than we require and demanding more of our attention than we can spare. The problem will be exacerbated as systems progress and proliferate. (5 figures, 23 refs.)
DTIC
Aerial Reconnaissance; Surveillance

20030108646 NASA Langley Research Center, Hampton, VA, USA
An Analysis of Measured Sonic-Boom Pressure Signatures From a Langley Wind-Tunnel Model of a Supersonic-Cruise Business Jet Concept
Mack, Robert J.; October 2003; 19 pp.; In English
Contract(s)/Grant(s): WU 23-706-92-02
Report No.(s): NASA/TM-2003-212447; L-18069; NAS 1.15:212447; No Copyright; Avail: CASI; A03, Hardcopy

Pressure signatures generated by the wind-tunnel model of a Business-Jet Concept were measured at a Mach number of 2, at (1ift/cruise lift) ratios of 0.5 and 1.0, and at separation distances of 9.5 and 18 inches. Analysis of the pressure signature data showed the engine-nacelle disturbances were as difficult to 'hide' in the flow-field of a 10-passenger supersonic-cruise business jet as they were in the similar part of the flow-field of a 300-passenger supersonic-cruise transport. This result indicated that it was more, not less, difficult to tailor the business-jet concept's geometry for sonic boom overpressures that were half those required of the much larger transport aircraft.
Author
Overpressure; Sonic Booms; Supersonic Transports; Wind Tunnel Models; Aircraft Design; Civil Aviation

20030108762 Massachusetts Inst. of Tech., Cambridge, MA
Hierarchical Nonlinear Control for Unmanned Aerial Vehicles
Dahleh, M. A.; Tsitsiklis, J.; Jul. 31, 2002; 8 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0320
Report No.(s): AD-A417306; MIT-6877600; AFRL-SR-AR-TR-03-0224; No Copyright; Avail: CASI; A02, Hardcopy

This research is motivated by the problem of motion planning of autonomous vehicles in an uncertain environment. A possible approach to reduce the computational complexity of the motion planning problem for a nonlinear, high dimensional

system, is based on a quantization of the system dynamics, in the sense that we restrict the feasible nominal system trajectories to the family of time-parametrized curves that can be obtained by the Inter-connection of appropriately defined primitives. These primitives will then constitute a maneuver library' from which the nominal trajectory will be constructed. Instead of solving an optimal control problem over a high-dimensional, continuous space, we solve a mixed integer programming problem, over a much smaller space. At the core of the control architecture lies a hybrid automaton, the states of which represent feasible trajectory primitives for the vehicle. Each constituent subsystem of the hybrid controller will be the agent responsible for the maneuver execution. The task of the automaton will be the generation of complete, feasible and optimal' trajectories, via the interconnection of the available primitives. Apart from the reduction in computational complexity, one of the objectives of this approach is the ability to provide a mathematical foundation for generating a provably stable hierarchical system, and for developing the tools to analyze robustness in the presence of uncertainty in the process as well as in the environment.
DTIC
Trajectory Control; Pilotless Aircraft; Optimal Control

20030108801 Naval Postgraduate School, Monterey, CA
An Experimental Investigation of the Geometric Characteristics of Flapping-Wing Propulsion for a Micro Air Vehicle
Papadopoulos, Jason; Jun. 2003; 89 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417547; No Copyright; Avail: CASI; A05, Hardcopy

The geometric characteristics of flapping-wing propulsion are studied experimentally through the use of a force balance and a Micro Air Vehicle (MAV) system. The system used is built to duplicate the propulsion system currently on the flying model at the Naval Postgraduate School (NPS) MAV model. Experiments are carried out in a low speed wind tunnel to determine the effects of mean separation and plunge amplitude on the flapping wing propulsion system. Additionally, the effects on flapping wing shape, frequency, and MAV angle on attack (AoA) are also investigated. Some flow visualization is also performed. The intent is to optimize the system so that payload and controllability improvements can be made to the NPS MAV.
DTIC
Remotely Piloted Vehicles; Experimentation; Flapping; Geometric Accuracy; Wings; Propulsion System Configurations

20030108803 Naval Postgraduate School, Monterey, CA
A Water Tunnel Investigation of a Small Scale Rotor Operating in the Vortex Ring State
Rumsey, Charles B., Jr; Jun. 2003; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417550; No Copyright; Avail: CASI; A05, Hardcopy

Motivation to expand the understanding of a helicopter rotor descending into the vortex ring state (VRS) stems from the aircraft mishaps that have plagued the helicopter community. The V-22 has become the most recent victim of encounters with VRS. The onset of VRS is associated with the collapse of the helical vortex wake in the plane of the rotor. The resulting wake disturbances develop an irregular and aperiodic flow. Rotor blade interaction with the disturbed vortices causes large variations in the blade spanwise aerodynamic load distribution. Harmonic analysis of the loading indicates that higher harmonic content becomes prevalent in this state. The dynamic flow similarities achieved in a water tunnel are used to explore flow visualization and conduct vibration analysis of a rotor system operating in the VRS. A scaled rotor system was operated in the NPS Aeronautical Engineering Department's water tunnel. Sensors were used to gather thrust and vibration power spectrum data when operating in VRS. Experimental results correlate with full scale flight data and show a significant increase in the vibration levels of the even multiples of the blade passage frequency. The relative strength of these higher harmonics can be used as an indicator of impending VRS encounters.
DTIC
Rotor Blades; Water Tunnel Tests; Hydraulic Test Tunnels; Rotary Wings; Vortex Rings

20030109084 California Univ., San Diego, La Jolla, CA
Stabilization of Nonlinear PDE's and Applications to Control of Flows
Krstic, Miroslav; May 2003; 11 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0019
Report No.(s): AD-A417657; AFRL-SR-AR-TR-03-0432; No Copyright; Avail: CASI; A03, Hardcopy

We have contributed in three general areas that are relevant to high performance control of aerospace vehicles. We have developed systematic techniques for real time optimization using the method of extremum seeking. This method is now highly

general applicable to multivariable problems, to problems with time-varying parameters, to problems involving slow dynamics where fast convergence is demanded, to problems where the objective is convergence to any value of the gradient (not just zero). to problems that involve limit cycles (unsteady extrema). and to problems that evolve in discrete time. Examples of applications that we have pursued include formation flight, compressor stall and surge, arid thermoacoustic combustion instabilities. In 2003 we published a research monograph on extremum seeking. In the area of flow control we have pioneered the use of stabilization for drag reduction and mixing. Employing Lyapunov techniques, we have solved flow control problems in channels, pipe geometries, flows around bluff bodies, and jet flows. In 2002 we published the first book dedicated to control algorithm design for fluid flows. For a broad class of linear parabolic distributed parameter systems we pioneered a back-stepping method for solving the boundary control stabilization problems. This is the first method that yields explicit solutions for both the control laws and for the closed-loop solutions. The implications of this are impossible to overstate-the design is direct and free of numerical issues, and the well posedness analysis is trivial (it is a bonus to the explicit design process). For several nonlinear PDEs we solved global stabilization problems in the presence of parametric uncertainties and input dynamics, paving the way for a future general theoretical development for nonlinear PDEs.
DTIC
Aerospace Vehicles; Control Theory; Flow Geometry; Fluid Flow; Nonlinearity; Pulse Detonation Engines

20030109094 Naval Research Lab., Stennis Space Center, MS
Addendum to the Software Users' Manual (Third Edition) for the AV-8B Map System II: Moving-Map Composer Version 3.6
Myrick, Stephanie A.; Trenchard, Michael E.; Watkins, Jessica L.; Aug. 29, 2003; 6 pp.; In English
Contract(s)/Grant(s): Proj-74-5236-13
Report No.(s): AD-A417468; NRL/MR/7440--03-8699-ADD; No Copyright; Avail: CASI; A02, Hardcopy

This report is an addendum to the third edition of the Moving-Map Composer (MMC) Users' Manual (NRL/FR/7440-00-10, 041). It reflects changes implemented for the latest release of MMC version 3.6, which include: 1) More efficient and automated Aircraft Optical Disk (AOD) recycling enhancements that reduce the number of superdirectories used; 2) Correction of reported problems with the dataframe manager; 3) Correction of reported problems with scanning paper charts. All other MMC functionality and procedures remain unchanged. Please see Appendix A for known non-critical errors or untested function.
DTIC
Manuals; User Manuals (Computer Programs); Harrier Aircraft

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

Includes all avionics systems, cockpit and cabin display devices, and flight instruments intended for use in aircraft. For related information see also *04 Aircraft Communications and Navigation; 08 Aircraft Stability and Control; 19 Spacecraft Instrumentation and Astrionics*; and *35 Instrumentation and Photography*.

20030108640 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Fabry-Perot Interferometer for Column CO2: Airborne
Kawa, S. R.; Heaps, W. S.; Mao, J.; Andrews, A. E.; Burris, J. F.; Miodek, M.; Georgieva, E.; [2002]; 1 pp.; In English; American Geophysical Union Fall Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Global atmospheric CO2 measurements are essential to resolving significant discrepancies in our understanding of the global carbon budget and, hence, humankind's role in global climate change. The science measurement requirements for CO2 are, however, extremely demanding (precision approximately 0.3%). We are developing a novel application of a Fabry-Perot interferometer to detect spectral absorption of reflected sunlight by CO2 and O2 in the atmosphere that should be able to achieve sufficient sensitivity and signal-to-noise to measure column CO2 at the target specification. We are currently constructing a prototype instrument for deployment on aircraft. The aircraft version will measure total column CO2 and CO2 below the aircraft as well as O2, which allows normalization of CO2 column amounts for varying surface height and pressure. This instrument will be a valuable asset in carbon budget field studies as well as a useful tool for evaluating existing and future space-based CO2 measurements. We will present the instrument concept, sensitivity calculations, and the results of testing a

bench system in the laboratory and outdoors on the ground. We will also discuss our plan for deployment on the aircraft and potential flight applications to the CO2 budget problem.
Author
Carbon Dioxide Concentration; Fabry-Perot Interferometers; Climatology; Remote Sensing; Airborne Equipment

07
AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power; 28 Propellants and Fuels*; and *44 Energy Production and Conversion*.

20030108713 Texas A&M Univ., College Station, TX, USA
Smart Structural Components and Simulation Tools for Increased Engine Efficiency, Flight Range, and Safety
Palazzolo, Alan; Sun, Guangyoung; Tucker, Randall; Kaushik, Nikhil; Preuss, Jason; Kenny, Andrew; Subramaniyam, Lakshmi; Hunt, Andrew; April 2003; 332 pp.; In English; See also 20030108714 - 20030108723; Original contains color illustrations
Contract(s)/Grant(s): NCC3-928; WU-708-87-23-00
Report No.(s): NASA/CR-2003-212205; NAS 1.26:212205; E-13809; No Copyright; Avail: CASI; A15, Hardcopy

Summaries of research work for two major topic areas, high temperature magnetic bearings and blade loss mitigation, are presented. Design concepts for a 1000 'F/25000 rpd1000 Ib. force thrust magnetic bearing and accompanying test rig is discussed via detailed Solid Works modeling. Shaft support is supplied by two ball bearings which are flexibly mounted in the axial direction to allow the full force of the magnetic bearing to be applied to a pair of axial load cells. Positioning screws are designed to permit alignment and clearance adjustments for the magnetic bearing. Centrifugally induced stresses are shown to be at acceptable levels with the hyperbolic profile design of the thrust runner. Test results confirm the ability of uniquely designed C cores to withstand a 1000 OF operating environment and to exhibit high (>500V) breakdown voltages. Future work includes completion of the test rig, development of high temperature displacement sensors and catcher bearings, and identification of flight-quality controllers and power amplifiers. Progress in the blade loss mitigation area includes simulations of ball bearing response to high dynamic loading, along with incorporation of a high fidelity bearing model (HFBM) into a flexible shaft, twin-spool gas turbine engine, vibration simulation model. The HFBM includes individual ball dynamics, nonlinear load deflection characteristics plus a squeeze film damper model. A specialized MATLAB code and CUI is provided for obtaining power loss and stiffness of ball bearings. Future work includes efficient simulation capability for an engine model with a HFBM for every bearing and a structural response representation with 300 modes. In addition, the capabilities of magnetic suspensions for mitigating blade loss will also be developed via high fidelity component and large order system simulation.
Author
Magnetic Bearings; Turbine Blades

08
AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also *05 Aircraft Design, Testing and Performance* and *06 Avionics and Aircraft Instrumentation*.

20030108783 Naval Research Lab., Stennis Space Center, MS
Demonstration of a Moving-Map System for Improved Precise Lane Navigation of Amphibious Vehicles and Landing Craft
Lohrenz, M. C.; Edwards, S. S.; Myrick, S. A.; Gendron, M. L.; Trenchard, M. E.; Jan. 2003; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417527; NRL/PP/7440--03-1019; No Copyright; Avail: CASI; A02, Hardcopy

The Naval Research Laboratory (NRL) has tested and demonstrated a prototype moving-map system for naval landing craft and amphibious vehicles. NRL proposed that a moving-map would improve crew situational awareness and communications, thereby improving precise lane navigability. This paper presents results of demonstrations performed during the Transparent Hunter naval exercise in January 2003. Comparisons in navigation performance (measured in terms of root mean square cross-track error) are presented for vehicles using the moving-map system and the same vehicles using no

moving-map. These results suggest that the moving-map significantly improves lane navigation performance. Crew feedback was also positive: crewmembers reported that the moving-map was easy to operate with minimal training and very effective in helping operators keep the vehicle within the lane.
DTIC
Feedback; Navigation Aids; Root-Mean-Square Errors; Situational Awareness

12
ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration see *91 Lunar and Planetary Science and Exploration*.

20030108453 Air Force Research Lab., Edwards AFB, CA, USA
Thruster-Imaging Analysis for Control of a Solar Concentrator
Beasley, Joseph N.; Jul. 23, 2003; 17 pp.; In English
Contract(s)/Grant(s): Proj-1011
Report No.(s): AD-A417134; AFRL-PR-ED-VG-2003-166; No Copyright; Avail: CASI; A03, Hardcopy

A major requirement for using a solar propulsion system is the proper placement of the focal spot on the thruster absorber plane. Without proper placement of the focal spot, solar energy is not transferred to the propellant gas, or in the worst case, a significantly smaller proportion of the incident energy is transferred to the gas. Previous work has determined that alignment accuracy needs to be 0.1 degree for angular and 0.1 inch for translation. Human-in-the-loop fine focus image processing can handle the focal spot positioning, but human-in-the-loop sensors and algorithms need to be replaced with a space flight-oriented solution. The problem of positioning the solar focal spot on the thruster absorber is due to the visual complexity of the absorber, which is compounded by specular reflection from the secondary concentrator. A charge-coupled device camera, the SBIG ST-6, was chosen as the fine focus device for this study. An SRS 1x2 meter elliptical concentrator was used to form images on the thruster. Thruster images were taken at 1-inch intervals in both vertical and horizontal locations using the 1m x 2m concentrator and a simulated light source. A scissors jack on block was used to vary the position of the light source. A Sony notebook computer was used to take the images, and Matlab was used for image enhancement and analysis. Histogram equalization of the images was necessary before final processing. Results show that averaging filtering was the most useful filtering for using the STFT for determining focal spot location. Laplacian and Gaussian filtering was not useful for STFT, but may be useful for locating specular reflections using other methods. The study shows that images should be taken using a variety of exposures to ensure that the image histograms are more reasonably populated. (10 figures)
DTIC
Solar Collectors; Solar Energy; Solar Propulsion; Specular Reflection; Thrustors

20030108517 Arcon Corp., Waltham, MA
Installation and Operation of Particle Transport Simulation Programs to Model the Detection and Measurement of Space Radiation by Space-Borne Sensors
Woolf, Stanley; Jan. 3, 2002; 98 pp.; In English
Contract(s)/Grant(s): F19628-99-C-0077; Proj-2822
Report No.(s): AD-A417247; UTD-STR-A002-01-630117; AFRL-VS-TR-2002-1675; No Copyright; Avail: CASI; A05, Hardcopy

This is a report of technical progress made during 1 Aug 00 to 31 Jul 01 in the areas of: (1) research and evaluation of particle transport simulation programs for modeling the detection and measurement of space radiation by space-borne sensors; (2) construction of realistic flight sensor computer models; (3) performance of particle transport calculation; (4) analysis of transport simulation results, including single particle tracking; (5) addition of new capabilities such as single particle tracking and specialized source geometry to an existing particle transport simulation program; (6) space-borne dosimeter simulation studies; (7)three-dimensional visualization of ITS-ACCEPT and MCNPX were applied to the modeling of the geometry files. The computer programs ITS-ACCEPT and MCNPX were applied to the modeling of the CEASE and HEP sensors. Shown in this report are listings of input files with geometry/materials drawings for the various simulation programs, annotated

computer code listings showing program modifications and partial listings of computer code outputs for individual particle tracking and coincidence event identifications.
DTIC
Electromagnetic Radiation; Space Flight

20030108669 Aerospace Corp., El Segundo, CA
Design of a Low-Cost, Lightweight, Passively Cooled, Narrowband, SWIR camera for Space-Based Imaging
Rudy, R. J.; Dotan, Y.; Hecht, J. H.; Mabry, D. J.; Sivjee, M. G.; Warren, D. W.; Jul. 5, 2003; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04701-00-C-0009
Report No.(s): AD-A417112; TR-2003(8570)-10; SMC-TR-03-20; No Copyright; Avail: CASI; A03, Hardcopy

This document describes the conceptual design for a spaceborne imager operating in the short-wave infrared (SWIR). The instrument was designed to image a single emission line of OH from the night sky from a satellite in low Earth orbit, but much of the design is relevant to other imaging applications. The imager has a 23.40 FOV in the crosstrack direction with a resolution of 1.6 mrad. It functions like a line scanner but incorporates a two-dimensional (256 x 256) InGaAs focal-plane array (FPA) to attain high signal-to-noise. It employs a set of telecentric foreoptics to accommodate narrowband imaging, but a simpler design would serve for broadband measurements. It uses a small radiator to passively cool the FPA to <200K and direct radiation by the support assembly to reduce the temperature of the optics. A novel approach that accomplishes TDI (time, delay, integrate) off of the focal plane obviates the need for a step/stare mirror. The design has no moving parts, weighs less than 6 kg, and consumes less than 15 W of power.
DTIC
Low Cost; Short Wave Radiation; Narrowband; Cameras; Imaging Techniques; Infrared Instruments

15
LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing and Performance*; and *20 Spacecraft Propulsion and Power*.

20030109321 Amptek, Inc., Bedford, MA
Space Systems Environmental Interaction Studies
Morgan, M. A.; Huber, Alan C.; Sperry, David J.; Donkin, Alan N., Jr.; Moran, Scott J.; Aug. 30, 2001; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-96-C-0144; Proj-2822
Report No.(s): AD-A417622; AFRL-VS-TR-2003-1529; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the objectives and summarizes the outcome, of the work performed under this contract. In addition, and this constitutes the major portion of the report, a comprehensive summary of all the important design elements for the anticipated DIDM-3 instrument is presented herein. As the final effort of the contract, all of the various facets to designing and building a Digital Ion Drift Meter for inclusion in the Communication/Navigation Outage Forecast System (CINOPS) spacecraft's instrument suite, within the imposed size and power constraints, and capable of realizing the desired measurement performance, were looked at and analyzed. An instrument design featuring a Backgammon type anode with four charge amplifiers and four Digital Pulse Processors (DPP) was examined in-depth, in order to determine the following: (i) if a design can be produced which provides optimal performance, and (ii) whether the design provided adequate imaging resolution for the drift measurements. The design optimization efforts were reported on in a previous AFRL publication (AFRL-VS-TR-2001-1660). An indication of the expected measurement accuracy and resolution is included here.
DTIC
Amplifiers; Ionospheric Disturbances; Spread F

20030109328 Flight Unltd., Flagstaff, AZ, USA
Study to Determine the Effective and Cost of a Laser-Propelled Lightcraft Vehicle System - Results to Guide Future Developments
Froning,; Pike,; McKinney,; Mesad, Frank, Jr.; Larson, Bill; Oct. 2003; 13 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-4847
Report No.(s): AD-A417729; AFRL-PR-ED-VG-2003-221; No Copyright; Avail: CASI; A03, Hardcopy

This document is a report of a study to determine the effective and cost of a laser-propelled lightcraft vehicle system - results to guide future developments.
DTIC
Laser Beams; Propulsion

20030109335 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA
Launching of Micro-Satellites Using Ground-Based High Power Pulsed Lasers
Hasson, V.; Mead, F. B., Jr.; Larson, C. W.; Oct. 2003; 45 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-4847
Report No.(s): AD-A417661; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Pulsed Lasers; Microsatellites

20
SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

20030108401 Air Force Research Lab., Edwards AFB, CA, USA
Economics of Test Stand Renovation/Rebuilding
Harder, David; Aug. 29, 2003; 15 pp.; In English
Report No.(s): AD-A417217; AFRL-PR-ED-TP-2003-218; No Copyright; Avail: CASI; A03, Hardcopy
This paper provides some background information related to space infrastructure, rocket propulsion and rocket engine testing and discusses some economic considerations in the renovation/rebuilding of rocket engine Test Stands 1D and 2A at Edwards AFB CA. Various means used to minimize renovation/ re-building costs and schedule are discussed as is the current state of the commercial rocket launch business.
DTIC
Rocket Engines; Propulsion

23
CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

20030108527 North Dakota State Univ., Fargo, ND, USA
Advanced Marine Coatings for Naval Vessels - Phase 1. Antifouling and Fouling Release Coatings
McCarthy, Gregory J.; Ready, Thomas E.; Webster, Dean C.; Choi, Seok-Bong; Boudjouk, Philip; Sep. 30, 2003; 48 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0794
Report No.(s): AD-A417348; No Copyright; Avail: CASI; A03, Hardcopy
This report describes the first phase of a long-term program aimed at establishing a facility that can address protective coatings research needs of the Department of Defense using the latest in combinatorial materials chemistry high-throughput discovery and evaluation methodology. The protective coatings application being addressed is environmentally compliant antifouling and fouling release coating for Navy ships. The objectives of Phase I were to: (1) initiate research on novel antifouling and fouling release coatings, and (2) develop and implement a facility for combinatorial high throughput experimentation for polymer materials and marine coating design, development, and evaluation. Both objectives were accomplished. The first groups of coatings, containing novel bound biocides on a silicone backbone and prepared through conventional synthesis methods, had several formulations that gave promising results during tests at ONR-supported test sites.
DTIC
High Polymers; Protective Coatings; Synthesis (Chemistry)

20030108691 Drexel Univ., Philadelphia, PA

Successful Initial Development of Styrene Substitutes and Suppressants for Vinyl Ester Resin Formulations

La Scala, John J.; Robinette, Eric J.; Palmese, Giuseppe R.; Sands, James M.; Orlicki, Joshua A.; Aug. 2003; 60 pp.; In English; Original contains color illustrations

Report No.(s): AD-A417370; ARL/APG-TR-3023; No Copyright; Avail: CASI; A04, Hardcopy

Recently, the U.S. Environmental Protection Agency (EPA) increased legislation to address hazardous emissions from composite manufacturing and repair by enacting new emission standards through the 'National Emission Standards for Hazardous Air Pollutants: Reinforced Plastic Composites Production,' which specifically targets styrene, methyl methacrylate, and methylene chloride as regulated hazardous air pollutants (HAP). Volatile organic compound (VOC) emissions are liberated during all phases of composite fabrication (Figure 1). Styrene emissions occur during the mixing of diluents, catalysts, and initiators into the system. Composite parts typically have very large surface-to-volume ratios, which allow up to 20% of the styrene content to be lost during the molding stage. During cure, elevated temperatures increase the vapor pressure of styrene and thus increase the rate of VOC emissions. Unfortunately, even alter cure during the lifetime of the part, styrene emissions can be substantial. Past work has shown that up to 50% of the styrene is unreacted after cure (1). Therefore, liberation of VOC emissions must be mitigated not only during composite processing, but also during curing and fielding of the composite part.

DTIC

Styrenes; Substitutes; Plastics; Vinyl Polymers

20030108763 Naval Postgraduate School, Monterey, CA, USA

A Cost Effectiveness Analysis of Using Alternate Materials for Non-Skid in Shipboard Applications

Boenisch, Kurt P.; Cervantes, Hector A.; Clark, Andrew J., IV.; Espe, Jesse G.; Lohrke, Erik B.; Jun. 2003; 73 pp.; In English; Original contains color illustrations

Report No.(s): AD-A417331; No Copyright; Avail: CASI; A04, Hardcopy

This MBA project investigated and evaluated the cost effectiveness of using alternative materials in shipboard construction, specifically in the area of non-skid application on surface ships. This project identified the costs and benefits of different alternatives to the currently used non- skid and identified whether these alternatives would be feasible for use on board Navy ships. The analysis indicates that the Therm ion alternative shows the potential for the most significant cost savings across the Surface Fleet, while the Liquidmetal alternative also shows potential for savings compared to the current status quo. It is recommended that both the Therm ion and Liquidmetal alternatives be prototyped on Navy warships to better define their costs and benefits and evaluate their suitability for use.

DTIC

Metals; Cost Effectiveness; Amorphous Materials; Ships; Alternatives; Navy

20030108965 Air Force Research Lab., Edwards AFB, CA, USA

POSS is not Just a Sphere: (Living Next Door to a Fluorine Chemist)

Viers, Brent D.; Mabry, Joseph; Gonzalez, Rene L.; Mar. 5, 2003; 17 pp.; In English

Contract(s)/Grant(s): Proj-4847

Report No.(s): AD-A417427; AFRL-PR-ED-VG-2003-055; No Copyright; Avail: CASI; A03, Hardcopy

This document is a report of POSS(Polyhedral Oligomeric Silsesquioxane).

DTIC

Fluorine; Polymers; Polyhedrons

20030109064 Air Force Research Lab., Edwards AFB, CA, USA

Methyl Tin(IV) Derivatives of HOTeF5 and HN(SO2CF3)2

Vij, Ashwani; Wilson, William W.; Vij, Vandana; Boatz, Jerry A.; Corley, Robert C.; Sep. 11, 2003; 19 pp.; In English

Contract(s)/Grant(s): Proj-DARP

Report No.(s): AD-A417388; AFRL-PR-ED-VG-2003-219; No Copyright; Avail: CASI; A03, Hardcopy

Tin Compounds; Crystal Structure

20030109305 Air Force Research Lab., Edwards AFB, CA, USA

Quantum and Classical Studies of the O(3P)+H2(v=0- 3,j=0) > OH + H Reaction Using Benchmark Potential Surface

Braunstein, M.; Adler-Golden, S.; Maiti, B.; Schatz, G. C.; Sep. 16, 2003; 24 pp.; In English

Contract(s)/Grant(s): F04611-03-C-0015

Report No.(s): AD-A417669; AFRL-PR-ED-TP-2003-229; No Copyright; Avail: CASI; A03, Hardcopy

We present results of time dependent quantum mechanics (TDQM) and quasi-classical trajectory (QCT) studies of the excitation function for O((3)P) + h2(v=0-3,j=0) - OH + H from threshold to 30 kcal/mol collision energy using benchmark potential energy surfaces Rogers et al. J. Phys. Chem. A 104, 2308 (2000). For H(2)(v=0) there is excellent agreement between quantum and classical results. The TDQM results show that the reactive threshold drops from 10 kcal/ mol for v=0 to 6 for v=1, 5 for v=2 and 4 for v=3, suggesting a much slower increase in rate constant with vibrational excitation above v=1 than below. For H(2)(v>0), the classical results are larger than the quantum results by a factor 2 near threshold, but the agreement monotonically improves until they are within approx. 10% near 30 kcal/mol collision energy. We believe these differences arise from stronger vibrational adiabaticity in the quantum dynamics, an effect examined before for this system at lower energies. We have also computed QCT OH(v,'j') state- resolved cross sections and angular distributions. The QCT state-resolved OH(v') cross sections peak at the same vibrational quantum number as the H(2) reagent. The OH rotational distributions are also quite 'hot' and tend to cluster around high rotational quantum numbers. However, the dynamics seem to dictate a cutoff in the energy going into OH rotation. The state-resolved OH distributions were fit to probability functions based on conventional information theory extended to include an 'energy gap' law for product vibrations and angular momentum constraints for product rotations.
DTIC
Potential Energy; Quantum Mechanics; Chemical Reactions; Angular Distribution

20030109333
Polyazide Chemistry Preparation and Characterization of Te(N3)4 and P(C6H5) 42Te(N3)6
Haiges, Ralf; Boatz, Jerry A.; Gerken, Michael; Schneider, Stefan; Schroer, Thorsten; Jan. 2003; 23 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-DARP
Report No.(s): AD-A417748; AFRL-PR-ED-TP-2003-222; No Copyright; Avail: CASI; A03, Hardcopy
The azido-group is highly energetic and adds about 70 kcal/mol to the energy content of a molecule. It is, therefore, not surprising that polyazides are highly endothermic compounds, and that their energy content increases with an increasing number 9f azido ligands. Compared to the relatively stable azide anion, which possesses two double bonds, the bonds in covalent azides are polarized towards a single and a triple bond, which greatly facilitates N2 elimination and enhances their shock sensitivity.
DTIC
Endothermic Reactions; Nitrogen Compounds

20030109336 SRI International Corp., Menlo Park, CA, USA
Nano/HEDM Technology: Late Stage Exploratory Effort
Bottaro, Jeffrey C.; Petrie, Mark; Penwell, Paul E.; Dodge, Allen L.; Malhotra, Ripu; Oct. 2003; 40 pp.; In English
Contract(s)/Grant(s): F49620-02-C-0030; Proj-L154
Report No.(s): AD-A417664; AFRL-SR-AR-TR-03-0435; No Copyright; Avail: CASI; A03, Hardcopy
This work is focused on a continued, escalating effort to develop new energetic functional groups which offer enhanced energy, oxygen balance, and density in that order of priority. A continuation of the study of addition of nitrene precursors to N,N-dialkyl nitrosamines is described; the nitrene derived from 1-amino-3,5-dinitro-1 ,2,4-triazole has been approached by oxidation of the parent amine. Initial results were not successful; aminodinitrotriazole in the presence of lead tetra-acetate does not produce detectable yields of dinitrotriazolyl azoxy dimethyl amine when aminodinitrotriazole and lead tetra-acetate are reacted in the presence of N,N-dimethylnitrosamine. The synthesis of the 5- nitrotetrazole-2-N-oxide anion has been realized and optimized; it is carried out in water/potassium acetate buffer, and proceeds in 90% yield; due to the small enthalpy of this oxidation, scale up and heat dissipation do not present a problem. The density of hydroxyl ammonium 5-nitrotetrazole-2- oxide is 1.82 g/cc; its enthalpy of formation is +40 kcal/mole. Finally, a practical pathway to 1-alkoxy-5-amino tetrazoles has been developed; it is hoped that this will enable the synthesis of 5-nitrotetrazole-1 ,3-bis-N-oxides, a family of unprecedented materials with excellent heats of formation and oxygen balance that rivals ammonium perchlorate and ammonium dinitramide.
DTIC
Organic Compounds; Nanotechnology; Nitrogen Compounds

20030109344 Massachusetts Inst. of Tech., Cambridge, MA
Identity and Dynamics of the Microbial Community Responsible for Carbon Monoxide Oxidation in Marine Environments
Tolli, John D.; Sep. 2003; 198 pp.; In English
Contract(s)/Grant(s): OCE-0136876
Report No.(s): AD-A417755; MIT/WHOI-2003-16; No Copyright; Avail: CASI; A09, Hardcopy

As colored dissolved organic matter in seawater absorbs UV solar radiation, a variety of simple chemical species are produced, including carbon monoxide (CO). The ocean surface water is saturated with respect to CO, and is thus a source of CO to the atmosphere. CO reacts with and removes free-radical compounds, and may itself contribute to the greenhouse gas content of the atmosphere. An important sink for CO in seawater is the biological oxidation of CO to CO2 by marine microorganisms. The objectives of this study are to identify component members of the microbial community responsible for the oxidation of CO in coastal marine environments through a combination of recent microbiological and molecular approaches, and to estimate their contributions to total in situ CO bio-oxidation. The author utilizes an enrichment method that involves cultivation of bacteria on membrane filters, subsequent incubation with radiolabeled CO, and the use of autoradiography to screen colonies with the desired phenotype. Cell-specific CO-oxidation activity is determined for selected purified strains with a time-series 14CO-oxidation method. Molecular phylogeny based on 16S-rDNA gene sequence information within the context of the large and growing 16S database determines the phylogenetic relatedness and identity of marine CO-oxidizing bacteria that result from this cultivation program. The CO-oxidizing organisms isolated in this study with greatest activity are closely related to the Roseobacter and Paracoccus genera of the alpha- proteobacteria, collectively known as the 'marine alpha group. ' Other microorganisms found to oxidize CO at environmentally relevant rates are members of beta- and gamma-proteobacteria, and one in the Cytophaga-Flavobacterium-Bacteroides group. CO- oxidizing members of the marine alpha group contributed up to 40.7% of total CO oxidation occurring in coastal waters.
DTIC
Coasts; Bacteria; Oxidation; Carbon Monoxide; Sea Water

24
COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20030108674 NASA Marshall Space Flight Center, Huntsville, AL, USA
Developing a Contoured Deposition Head for In-Situ Tape Laying and Fiber Placement
Lamontia, Mark A.; Gruber, Mark B.; Funck, Steve B.; Waibel, Brian J.; Cope, Ralph D.; Hulcher, A. Bruce; [2003]; 15 pp.; In English; SAMPE International Symposium and Exhibition, 12-16 May 2003, Long Beach, CA, USA
Contract(s)/Grant(s): NAS8-00193; Copyright; Avail: CASI; A03, Hardcopy

A conformable compaction system employing three individual compactors has been designed for integration into fiber placement and tape laying deposition heads for out-of-autoclave fabrication of thermoplastic contoured parts. The compactors are intended to perform against two geometry specifications: (1) a general minimum radius of curvature limit of 180cm (71-in), and (2) a pad-up specification with a maximum height of 2.5mm (0.1-in.) and a minimum ramp of 25mm (1-in). The mirrored specification is applicable to a pan-down. The three designs include a hot line compactor capable of a 1000N (400-lb) force at 450 C over a 114mm (4.5-in) width, a hot area compactor capable of a 400N (100-lb) force at 450 C over a 114mm width by 76mm length (4.5- in by 3-in), and a cold compactor that combines the features of a line and an area compactor. The cold compactor's line segments act with a 2800N (700-lb) force across a 127mm (5-in) width, while the cold compactor's area segments act with a 1000N (250-lb) force over a 127mm by 102mm (5-in by 4-in) area. Two of the designs, the hot line and hot area compactors, have been constructed, developed, and proven out in hot mode to compact actual thermoplastic composite plies over undulating geometry. IM-7/PEEK [0/90/0/90]s pan-down and IM-7/PEKK [0/-45/90/45]2s pad-up laminates have been fabricated and photomicrographs show good microstructure.
Author
Laminates; Fabrication; Compacting; Thermoplasticity

20030109076 Triton Systems, Inc., Chelmsford, MA
Chopped Fiber Discontinuously Reinforced Aluminum
Karg, Karin; Powell, David; Burnett, Jim; Mar. 17, 2003; 9 pp.; In English
Contract(s)/Grant(s): Proj-3005
Report No.(s): AD-A417412; AFRL-PR-ED-TM-2003-068; No Copyright; Avail: CASI; A02, Hardcopy

This document is a report of the chopped fiber discontinuously reinforced aluminum.
DTIC
Composite Materials; Aluminum

20030109322 Kansas State Univ., Manhattan, KS, USA
Micro-Stress and Failure Analysis of Textile Composites
Wang, Youqi; Jun. 2003; 41 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0240
Report No.(s): AD-A417688; AFRL-SR-AR-TR-03-0365; No Copyright; Avail: CASI; A03, Hardcopy

Project objectives are the development of more optimal mechanics approaches for textile composite design and failure analysis. Tailoring of the textile composite microstructure is one of the most pressing research issues in textile composite design. The textile pre-forming process determines the microstructure of the textile preform. Preform microstructure determines textile composite micro-stress distribution. Development of a numerical approach that facilitates establishment of relations between textile microstructures and textile processes is, therefore, critical. In this project, two new numerical methods are developed. The first is a digital element simulation approach for textile mechanics. It enables simulation of the textile process as well as simulation of textile preform deformation. As a result, detailed knowledge of the textile preform microstructure becomes obtainable. The second method developed in this project is a heterogeneous element method for the micro-stress analysis of textile composites. Formulation of a heterogeneous element guarantees that both the equilibrium conditions and the continuity of displacement at the interface are satisfied. Yet, it allows for interface stress and strain jump. Because the formulation reflects the actual physical situation at the interface, it provides a much more accurate result than conventional approaches if the same mesh is used.
DTIC
Failure Analysis; Microstructure; Stress Distribution; Textiles; Composite Materials; Forming Techniques

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

20030108413 Army Research Office, Research Triangle Park, NC
Army Research Office and Air Force Office of Scientific Research: 2002 Contractors Meeting in Chemical Propulsion
Mann, David M.; Tishkoff, Julian M.; Jan. 2002; 193 pp.; In English
Report No.(s): AD-A417233; AFRL-SR-AR-TR-03-0347; No Copyright; Avail: CASI; A09, Hardcopy

Abstracts are given for 6.1 basic research in chemical propulsion sponsored by the Army Research Office and the Air Force Office of Scientific Research.
DTIC
Combustion; Chemical Reactions; Propulsion System Performance; Chemical Propulsion

20030108425 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA
Organic Polymers Modified with Inorganic Polyhedra
Haddad, Timothy S.; Gonzalez, Rene; Feb. 28, 2003; 28 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-2303
Report No.(s): AD-A417290; AFRL-PR-ED-VG-2003-048; No Copyright; Avail: CASI; A03, Hardcopy

Nano-sized inorganic clusters(POSS) can be successfully incorporated into a wide variety of different organic polymers. These POSS clusters cause increases to the thermal transitions and mechanical properties of the polymers they are copolymerized into. Not every POSS is the same and the POSS effect on the properties of analogous polymers shows a dependency on the type of alkyl group on the POSS cluster. Rheology of high molecular weight PDMS grafted with small amounts of POSS illustrates a dependence on both the POSS- alkyl-group and POSS shape. TEM images of randomly copolymerized polymers illustrate this dependency, as the size of the POSS domains are alkyl-group dependent.
DTIC
Polymers; Organic Compounds; Rheology; Inorganic Compounds

20030108426 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA
Fluorinated POSS
Mabry, Joseph M.; Ruth, Patrick N.; Blanski, Rusty L.; Gonzalez, Rene; Feb. 28, 2003; 36 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-4847
Report No.(s): AD-A417295; AFRL-PR-ED-VG-2003-049; No Copyright; Avail: CASI; A03, Hardcopy

Fluorinated POSS may be useful to make spacecraft coatings resistant to atomic oxygen by forming a silica-like passivating layer. Fluorinated POSS may be useful in fluoropolymer seals and gaskets to increase mechanical strength and improve creep characteristics. Fluorinated POSS may also be useful to decrease surface energy in hydrophobic surfaces.
DTIC
Oxygen Atoms; Hydrophobicity; Fluorination; Polyhedrons; Oligomers

20030108427 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA
POSS Polystyrene Copolymers Reactivity and Control
Moore, Brian; Haddad, Timothy; Gonzalez, Rene; Feb. 28, 2003; 25 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A417297; AFRL-PR-ED-VG-2003-047; No Copyright; Avail: CASI; A03, Hardcopy

Nano-sized inorganic clusters(POSS) can be incorporated into polystyrene copolymers from 1-99 wt%. These POSS clusters cause increases to the thermal transitions and mechanical properties of the polymers they are copolymerized into. The POSS effect on the properties of analogous polymers shows a dependency on the type of alkyl group on the POSS cluster. A degree of control over molecular weight can be made using standard kinetic polystyrene parameters. High molecular weight is necessary to maintain good mechanical properties. Reactivity ratios show that styrene monomer has no preference for reaction with itself or with a POSS-styrene. A POSS-styrene monomer, however, is more likely to react with styrene than with itself. Therefore, a copolymer sequence should be close to random.
DTIC
Polymers; Styrenes; Polystyrene; Copolymers; Monomers

20030108439 Air Force Research Lab., Edwards AFB, CA, USA
Thermodynamic Limitations on Energy Conversion in Laser Propulsion
Larson, C.W.; Mead, F.B., Jr.; Knecht, S.D.; Aug. 21, 2003; 24 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A417020; AFRL-PR-ED-VG-2003-209; AFRL-PR-ED-VG-2003-209; No Copyright; Avail: CASI; A03, Hardcopy

Outline: Comparison of Constant Momentum Mission and Constant Specific Impulse Mission; Efficiency of conversion of laser energy to propellant kinetic energy; Upper limit to conversion of laser energy to jet kinetic energy from energy conservation and definitions; Comparing momentum quantities to energy quantities. The 'Phi Factor' and velocity distributions in propellant jet. Phi values for delta function, Maxwellian, Gaussian, Chunks and gas, supersonic expansion, etc.; Upper limits to performance based on chemical thermodynamics. Blowdown from defined equilibrium state of known volume.
DTIC
Laser Outputs; Laser Propulsion; Pulsed Lasers; Propulsion System Configurations; Spacecraft Propulsion

20030108440 Air Force Research Lab., Edwards AFB, CA, USA
Thermodynamic Limitations on Energy Conversion in Laser Propulsion
Larson, C. W.; Mead, F. B., Jr.; Knecht, S. D.; Aug. 21, 2003; 12 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A417021; AFRL-PR-ED-TP-2003-208; AFRL-PR-ED-TP-2003-208; No Copyright; Avail: CASI; A03, Hardcopy

We show that perfect propulsion requires a constant momentum mission, as a consequence of Newton's second law. Perfect propulsion occurs when the velocity of the propelled mass in the inertial frame of reference matches the velocity of the propellant jet in the rocket frame of reference. We compare constant momentum to constant specific impulse propulsion, which, for a given specification of the mission delta V, has an optimum specific impulse that maximizes the propelled mass per unit jet kinetic energy investment. We also describe findings of more than 50% efficiency for conversion of laser energy into jet kinetic energy by ablation of solids.
DTIC
Laser Outputs; Laser Propulsion; Specific Impulse; Thermodynamics; Pulsed Lasers

20030108794 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA

System Design Methods for Simultaneous Optimal Control of Combustion Instabilities and Efficiency

Baumann, William T.; Saunders, William R.; Vandsburger, Uri; Greenwood, A.; Vaudrey, M.; Carson, M.; Sep. 30, 2002; 96 pp.; In English

Contract(s)/Grant(s): N00014-99-1-0752

Report No.(s): AD-A417542; VACCG-ONR-1; No Copyright; Avail: CASI; A05, Hardcopy

The work under this contract primarily involved the design, analysis and testing of control algorithms aimed at the suppression of thermoacoustic instabilities and the optimization of combustor performance. Three different types of algorithms were considered in this work: Pattern search, explicit gradient, and least-mean-square based feedback, which we have designated filtered-E. The algorithms are listed in order of increasing speed and increasing amount of a priori information required. Both pattern search and explicit gradient algorithms are useful for the optimization of combustion performance as well as the suppression of thermoacoustic instabilities. Filtered-E is intended solely for the fast suppression of thermoacoustic instabilities. All of the algorithms were successful in suppressing thermoacoustic instabilities in an experimental combustor. In addition, we provide an analysis of the mechanism for achieving control using on-off actuators pulsed subharmonically, validate the analysis with experimental results and propose a variable- subharmonic controller. Control systems using on-off actuation can be adaptively tuned using pattern search or explicit gradient algorithms with little modification. The filtered-E algorithm has also been effective when applied to on-off actuation, even though the implicit gradient is not quite correct.

DTIC

Systems Engineering; Combustion; Combustion Chambers; Stability; Thermoacoustic Effects; Design Analysis; Combustion Efficiency

20030109065 Air Force Research Lab., Edwards AFB, CA, USA

New Ionic Liquids

Drake, Greg; Hawkins, Tommy; Tollison, Kerri; Hall, Leslie; Vij, Ashwani; Sep. 9, 2003; 28 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A417389; AFRL-PR-ED-VG-2003-210; No Copyright; Avail: CASI; A03, Hardcopy

Ionic Crystals; Salts

20030109325 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA

First Structural Characterization of Binary As(III) and Sb(III) Azides

Haige, Ralf; Vij, Ashwani; Boatz, Jerry; Schneider, Stefan; Schroer, Thorsten; Jan. 2003; 39 pp.; In English

Report No.(s): AD-A417695; No Copyright; Avail: CASI; A03, Hardcopy

The highly explosive molecules As (N3)3 and Sb(N3)3 were obtained for the first time in pure form by the reactions of the corresponding fluorides with (CH3)3SiN3 in SO2 solution and purification by sublimation. The crystal structures, N-14 NMR and infrared and Raman spectra were determined and the results compared to ab initio second order perturbation theory calculations. Whereas Sb(N3)3 possesses a propeller-shaped, pyramidal structure with perfect C3 symmetry, the As(N3)3 molecule is significantly distorted from C3 symmetry due to crystal packing effects.

DTIC

Azides (Inorganic); Azides (Organic); Explosives; Raman Spectroscopy; Binary Alloys

20030109326 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA

Polynitrogen Chemistry

Christe, Karl O.; Sep. 23, 2003; 31 pp.; In English

Contract(s)/Grant(s): F04611-99-C-0025; Proj-DARP

Report No.(s): AD-A417697; AFRL-PR-ED-VG-2003-240; No Copyright; Avail: CASI; A03, Hardcopy

The novel Ns +HF2 salt was prepared and serves as a useful reagent for the preparation of other N5 + salts. The reactions of NF4+ and N2F3+ with HN3 were studied. While NF4+ acted only as a fluorinating agent, one F of N2F3 + was replaced by an azido group, but the substitution product was unstable and underwent rapid decomposition. The decomposition of complex fluoro salts of N2 + was studied both experimentally and computationally. It was shown that the life-time of FN5 is very short and that under our reaction conditions only the expected decomposition products can be observed. In pursuit of a bulk synthesis for N5- salts, it was shown that the N5- anion can be prepared in solution and be observed by N-15 NMR. Reliable thermodynamic calculations were camed out for N5 +N5- and N5+N3-. It is shown that the previous use of vertical

instead of adiabatic potentials led to very large errors and erroneous conclusions.
DTIC
Nitrogen Compounds; Synthesis (Chemistry); Complex Compounds; Chemical Reactions

20030109349 SRI International Corp., Menlo Park, CA
High Energy Density Materials
Bomberger, David; Bottaro, Jeffrey C.; Petrie, Mark; Penwell, Paul E.; Dodge, Allen L.; Sep. 2003; 52 pp.; In English
Contract(s)/Grant(s): F49620-00-C-0033; Proj-PE611009; Proj-PE63765E
Report No.(s): AD-A417725; SRI-P10926; AFRL-SR-AR-TR-03-0412; No Copyright; Avail: CASI; A04, Hardcopy

Synthetic pathways to the nitroazoxyamine, pentazole-N-oxide, and triazanitrate anions have been explored at a fundamental level. The reaction of nitrene equivalents such as organic azides, N-haloamines, N-acyl hydroxylamines N, O-diacyl hydroxylamines, and amides in the presence of lead tetra-acetate or phenyliodine diacetate, acting on N,N dialkylnitrosoamines in an attempt to generate alkylazoxyamines have all been examined. Initial results were not encouraging; in response to this, the N,N- dialkylnitrosoamine was silylated, methylated, and acylated to give 1,1-dialkyl-2silyloxy diazenium cation and its analogues. These cations were reacted with a wide array of nucleophillic nitrene equivalents such as fluoronitramide anion or monobromo- tert, butylamme; again, no azoxy amine was observed. Intramolecular versions of the above mentioned methodologies were contrived; the appropriate intermediates were synthesized, characterized, and subjected to a variety of conditions designed to effect the intramolecular synthesis of the alkylazoxyamine, a useful precursor to the heretofore unknown nitroazoxyamine (diazanitrate). Still, no obvious evolution of the desired azoxyamine was observed. Many variations remain to be explored. One clear success in this program was the invention of HYDROXYNITROUREA, a high density oxidizer with potential use as a replacement for perchiorate. Kilogram quantities were made and tested commercially; it tended to burn too fast at elevated pressures. The ammonium salt of HNU shows much promise as a burn rate attenuator, and this is presently being explored.
DTIC
Ammonium Compounds; High Energy Propellants; Synthesis (Chemistry)

26
METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20030108455 Dartmouth Coll., Hanover, NH
Directional Recrystallization Processing
Baker, I.; Frost, H. J.; Jul. 31, 2003; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-00-1-0076
Report No.(s): AD-A417169; AFRL-SR-AR-TR-03-0341; No Copyright; Avail: CASI; A03, Hardcopy

Fundamental research has been undertaken to understand how key microstructural parameters (grain size, particle spacing) interact with the processing conditions (temperature, rate of hot zone movement, temperature gradient in front of the hot zone) to control the microstructural evolution during directional recrystallization processing. The work involved close coupling of experiments with computer simulations. The computer simulation, in part, was to guide the choice of experimental parameters. A front-tracking grain- growth model was used to investigate the effects of hot zone width on the development of a columnar-grained structure and on its continued propagation. Analytical models were developed to explain both the critical hot zone velocity for the continued propagation of a columnar-grained structure and the relationship between the critical hot zone velocity and the hot zone width. The role of grain boundary energy and mobility on the development of a columnar grain structure were also explored. Experiments showed that most columnar grains produced in cold-rolled, directionally-recrystallized nickel have a ?124!<21> orientation. Small island grains left inside the columnar grains were shown either to have low-angle boundaries or to be twins.
DTIC
Grain Boundaries; Recrystallization; Microstructure

20030108682 NASA Marshall Space Flight Center, Huntsville, AL, USA
A New Analytical Approach to Predict Spacing Selection in Lamellar and Rod Eutectic Systems
Catalina, Adrian V.; Sen, Subhayu; Stefanescu, Doru M.; Metallurgical and Materials Transactions A; February 2003; Volume 34A, pp. 383-394; In English; Copyright; Avail: Other Sources

The Jackson and Hunt (JH) theory has been modified to relax the assumption of isothermal solid liquid interface used in their treatment. Based on the predictions of this modified theory, the traditional definitions of regular and irregular eutectics are revised. For regular eutectics, the new model identifies a range of spacing within the limits defined by the minimum undercooling of the a and beta phases. For the irregular Al-Si eutectic system, two different spacing selection mechanisms were identified: (1) for a particular growth rate, a nearly isothermal interface can be achieved at a unique minimum spacing lambda (sub t); (2) the average spacing (lambda (sub av) greater than lambda (sub t) is essentially dictated by the undercooling of the faceted phase. Based on the modified theoretical model, a semiempirical expression has been developed to account for the influence of the temperature gradient, which is dominant in the irregular Al-Si system. The behavior of the Fe-Fe3C eutectic is also discussed. The theoretical calculations have been found to be in good agreement with the published experimental measurements.
Author
Eutectics; Mathematical Models; Lamella (Metallurgy); Rods

20030109079
Dynamic Testing Materials
Jones, Stanley E.; Gillis, Peter P.; Oct. 2001; 244 pp.; In English
Contract(s)/Grant(s): F08630-96-K-0014; Proj-2502
Report No.(s): AD-A417651; AFRL-MN-EG-TR-2002-7001; No Copyright; Avail: CASI; A11, Hardcopy

The subject of this project was dynamic testing of materials at high strain rates Most of the effort was directed toward the Taylor Impact test. The Taylor Test is important because it helps bridge the gap between the split-Hopkinson pressure bar and flyer plate experiments. Another important feature of the Taylor test is the very large compressive strains that are achieved. New analytical tools were devised to reduce data from the Taylor test and a number of experiments were performed at the University of Alabama. To reduce the effect of radial inertia new low caliber launcher was built and 0.164 inch diameter specimens were tested. Taylor tests of viscoelastic materials for which a recovered deformed specimen was not possible, were also performed. In this case, a high speed film record of the impact event was substituted instead. Some progress was also made on quantifying the high rate behavior of some materials that are not candidates for the Taylor test. The mechanical properties of geologically based materials are often deduced from penetration tests where the appropriate rates and pressures are available. Improvements and modifications of existing one-dimensional hard target penetration models were undertaken.
DTIC
Dynamic Tests; Impact Tests; Strain Rate

20030109279 Aerospace Corp., El Segundo, CA
Stress Relaxation and Stiffness of 17-7PH Belleville Springs in a Stacked Configuration
Chang, D. J.; Steckel, G. L.; Jun. 20, 2003; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04701-00-C-0009
Report No.(s): AD-A417741; TR-2003(3901)-1; SMC-TR-03-26; No Copyright; Avail: CASI; A03, Hardcopy

An investigation was performed to determine the effects of parallel stacking on the stiffness and stress relaxation of 17-7PH Belleville springs. Parallel stacking refers to Belleville washers stacked with the concave side of all washers in the stack facing the same direction. Load versus displacement curves and stress relaxation data were generated for two single-disc experiments and for two double- disc, parallel stack experiments. In theory, the stiffness of a parallel stack of disc springs should be equal to the sum of the stiffness values for the individual springs. However, the measured stiffness values for the two double-disc stacks were only 73% and 85% of the respective sums for the individual discs. Spring force losses due to stress relaxation were always less than 2% for periods up to 1318 h. It was concluded that for displacement-controlled applications having stringent force requirements, spring stiffness must be measured for each disc, and load losses associated with a parallel, stacked configuration must be accounted for in the system design.
DTIC
Stainless Steels; Loads (Forces)

20030109310 North Dakota State Univ., Fargo, ND
Corrosion Protection of Aluminum Alloys Used in Aircraft: Testing, Analysis and Development of Environmentally Compliant Coatings and Pretreatments for the Corrosion Protection of Aircraft Alloys
Bierwagen, Gordon P.; Tallman, Dennis E.; Croll, Stuart; Boudjouk, Philip; Gelling, Victoria J.; Sep. 2002; 19 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0283; Proj-3484
Report No.(s): AD-A417676; AFRL-SR-AR-TR-03-0439; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the work for FY 2000 for the Project Corrosion Protection of Aluminum Alloys Used in Aircraft (Grant # F49620-99-1.0283) for AFOSR. This Report contains the following sections that address the technical goals of the project: Goal 1. Improved electrochemical test methods and protocols for characterizing the performance of coated aircraft alloys. Goal 2. Surface Analysis Studies of Degradation of Coatings Properties Goal 3. SVET studies of Coated Aluminum Alloys Goal 4. Advanced Spectroscopy of Coating/Metal Systems Goal 5. Further examination of conductive polymers for chrome free metal pretreatment primers for Al alloys Goal 6. Development of molecular probes for examining changes in thin coating films during exposure Goal 7. Electrochemical Instrumentation Development Goal 8. Chrome- free pretreatment materials based on sol-gel optimization - new silicon oligomer design & synthesis Goal 9. Improved design/expert systems methods for total aircraft coatings systems design (with AFRL/WPAFB).
DTIC
Aluminum Alloys; Coatings; Corrosion Prevention; Pretreatment; Aircraft Construction Materials

27
NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20030108419 Defence Research and Development Canada, Ottawa, Ontario, Canada
Accelerated Drying of Wet Boots
Dyck, Walter R.; Nov. 2002; 24 pp.; In English
Report No.(s): AD-A417255; DRDC-TR-2002-196; No Copyright; Avail: CASI; A03, Hardcopy

Much has been written about materials known as 'super absorbers' with respect to their ability to keep the skin dry in the presence of moisture. One such material is sodium polyacrylate. Because recent field trials with Canadian Forces soldiers have reconfirmed that donning wet combat boots is very uncomfortable, a study was done to assess the efficacy of using sodium polyacrylate based drying pads to dry wet combat boots in a simulated field environment. The boot used in this study was non-insulated, had a water resistant full grain leather upper, and lined with a waterproof, water-vapour permeable membrane covered with a nylon inner liner. A dry boot and pad were weighed and the boot was wetted inside and out. After the boot was removed from the water and the water poured out of the boot, a drying pad was placed inside the boot and the entire system was placed on electronic scales connected to a computer. The wetting characteristics of the pad and the drying characteristics of the boot were monitored and analysed at two temperatures, 15.8 deg. C and 23. 3 deg. C. The pad absorbed water very quickly, within about 30 minutes. It does not, however, pick up very much moisture, 62.9 to 78.9 grams. It is postulated that a soldier will require at least 4- 6 pads for drying his/her wet weather boots in the field.
DTIC
Sodium Compounds; Drying; Acrylic Resins

20030108443 Florida Univ., Gainesville, FL
Controlled Redox and Electrical Properties in Polyheterocycles
Reynolds, John R.; Jul. 21, 2003; 20 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0047; Proj-2303
Report No.(s): AD-A417055; TR-4; AFRL-SR-AR-TR-03-0294; No Copyright; Avail: CASI; A03, Hardcopy

The Reynolds research group at the University of Florida has developed an extensive program for the development and application of variable gap conjugated polymers which are luminescent and semiconducting, can be doped to high levels of conductivity, and can be redox switched between charge neutral, oxidized (p-type), and reductive (n-type) states. A soluble and processable dibutyl derivative of poly(3,4-propylenedioxy- thiophene) has been synthesized directly in its neutral form by Grignard metathesis which can be switched from deep red- purple in the neutral state to highly transmissive sky blue in the oxidized state. In addition, a full series of poly(3,4- alkylenedioxypyrroles) (PXDOPs) have been developed as electron rich electrochromic polymers where substitution in the N-position allowed us to attain the high gap/high HOMO polymers. These polymers exhibit multi-color and high contrast electrochromism. We have utilized in-situ colorimetric analysis and composite coloration efficiency to elucidate the properties of these electrochromic properties. We have applied these polymers to a series of electrochromic devices utilizing both absorption/ transmission and absorption/reflection designs to attenuate

electromagnetic absorption through a window or shutter, or off of a surface. By using PProDOP-NPrS as the anodically coloring layer, the contrast of the ECDs has been optimized to 68%.
DTIC
Oxidation-Reduction Reactions; Electro-Optics; Electrical Properties

20030108950 Aerospace Corp., El Segundo, CA
Electrical Resistivity of DC93-500 Silicone Adhesive
Morgan, B. A.; Apr. 10, 2003; 14 pp.; In English
Report No.(s): AD-A417430; TR-2003(1465)-1; SMC-TR-03-25; No Copyright; Avail: CASI; A03, Hardcopy

Dow Corning 93-500 clear silicone adhesive is used to attach protective cover glass material to solar cells. If the resistance of the DC93-500 becomes too great as temperatures approach -150 degrees C, then there is the potential for arc discharge, which could damage spacecraft electronics. Therefore, the question of electrical resistance as a function of temperature is important to the design process. In this report, measurements of resistivity are reported as a function of temperature. A change of slope in the resistivity versus log(temperature) graph at approximately -50 degrees C is reported. This phenomenon is linked to the crystalline phase transition.
DTIC
Electrical Resistance; Silicon Compounds; Adhesives

20030109063 Drexel Univ., Philadelphia, PA
Measurement of Stress in Ceramic Laminates With Micro-Raman
Orlovskaya, Nina; Jun. 30, 2003; 8 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0340; Proj-020890
Report No.(s): AD-A417380; AFRL-SR-AR-TR-03-0343; No Copyright; Avail: CASI; A02, Hardcopy

Residual stresses in laminate ceramic composites were measured by micro-Raman spectroscopy. The research proceeded from laminate samples preparation, which included the mixture of powders in certain proportions, grinding them up to submicron dispersity, rolling of the tapes, placing the tapes in a certain order, and hot pressing. Several different ceramic laminates, such as Ti3SiC2-ZrO2, B4C-SiC, and Si3N4- TiN, were used for the determination of residual stresses by micro-Raman. The AlMgB-TiB2 superhard laminates are being prepared by SHS powder synthesis and hot pressing. The residual stresses in Ti3SiC2-based laminates were not significant, because of the small mismatch in CTEs of Ti3SiC2 and ZrO2. In B4C-SiC laminates, residual stresses could be measured from the shift of transverse optic (TO, 790/cm) and longitudinal optic (LO, 973/cm) phonon modes. In silicon nitride-based laminates several Raman bands could be used for the determination of the surface residual stresses.
DTIC
Stress Analysis; Composite Materials; Laminates; Loads (Forces); Fractures (Materials); Ceramics; Residual Stress; Titanium Carbides; Titanium Nitrides; Fracture Strength; Stress Distribution

20030109081 Chicago Univ., Chicago, IL
Photorefractive Materials Exhibiting High Performances and Minimal Phase Separation
Yu, Luping; Jan. 2002; 54 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0055
Report No.(s): AD-A417654; No Copyright; Avail: CASI; A04, Hardcopy

This report summarises the research effort for the grant period as indicated above on multifunctional photorefractive materials. New synthetic approaches and new materials with much improved photorefractive properties have been developed. Detailed discussion and description are described in this report.
DTIC
Electroluminescence; Photorefractivity

20030109280 Connecticut Univ., Storrs, CT
Fundamental Studies of Novel Contact-Damage Resistant Ceramics
Fadture, Nitin P.; Suresh, Subra; Aug. 25, 2003; 20 pp.; In English
Contract(s)/Grant(s): F49620-OO-1-O1O4
Report No.(s): AD-A417740; AFRL-SR-AR-TR-03-0424; No Copyright; Avail: CASI; A03, Hardcopy

The concept of elastic-modulus-graded ceramics for improved resistance to quasi-static contact damage (Hertzian-

indentation), sliding-contact damage, and wear was investigated. In these graded materials, the in-plane elastic modulus (E) is low at the contact surface and high in the interior (substrate) with a continuous, or step-wise continuous, E-gradation in-between. Processing strategies for fabricating such E-graded ceramic composites in the A12O3(-) glass, the Si3N4(-)glass, and the Si3N4(-)SiC systems are described. The Hertzian indentation (quasi-static and sliding) behavior of these composites, along with some results from wear tests, are presented. Computational modeling (finite- element analysis or FEA) results are also presented, and are used to discuss the role of E-gradients in imparting contact- damage resistance to these materials. The use of calibrated FEA models as predictive tools for the design of next- generation graded materials is also discussed.
DTIC
Wear; Ceramics; Contact Resistance

20030109303 EIC, Inc., Norwood, MA, USA
Nanostructured Multifunctional Materials by Cure-Driven Phase Separation
Gilbert, Michael D.; Cogan, Stuart F.; Hines, Jeremy C.; Oct. 2003; 21 pp.; In English
Contract(s)/Grant(s): N00014-00-C-0443
Report No.(s): AD-A417668; 200002F; No Copyright; Avail: CASI; A03, Hardcopy

An investigation was conducted into the development of a self-healing fiber reinforced polymer (FRP) composite based on a nanostructured epoxy matrix resin, recently developed by EIC Laboratories. This novel material comprises a blend of epoxy and amphiphilic block copolymer, which separates during cure to form three separate phases of high strength epoxy, rubbery polar polymer and rubbery nonpolar polymer. The high strength epoxy and polar rubbery polymer are arranged in cocontinuous networks, while the third nonpolar rubbery polymer is arranged as discrete domains evenly distributed throughout the material. Reactive monomers, added to the uncured mixtures, will segregate into one of the rubbery phases depending on compatibility and will be free to diffuse to and repair, by polymerization, any voids formed in the matrix through microcracking or other accumulated damage. Segregated from the epoxy phase, these monomers do not plasticize or otherwise compromise the thermal mechanical properties of the matrix system. This study verifies the structure of the EIC material and provides evidence for the incorporation of active monomers within this material. The effect of these monomers on the durability and mechanical properties of composites is also assessed.
DTIC
Nanostructure (Characteristics); Epoxy Resins; Mechanical Properties; Phase Separation (Materials)

20030109330 Washington State Univ., Pullman, WA
Photorefractive Fibers
Kuzyk, Mark G.; Oct. 16, 2003; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-00-1-0120
Report No.(s): AD-A417731; AFRL-SR-AR-TR-03-0428; No Copyright; Avail: CASI; A02, Hardcopy

We have discovered that photo-isomerization in the simple DR1 molecule can be used for limiting in regions where the material is transparent. We have used this effect for various demonstrations of light control and beam shaping - prerequisites for making optical limiters. We have also developed a theory of what makes the maximum nonlinear response and have applied it to two photon absorption to determine The accomplishments of our research go well beyond the original scope of the project. In addition to our work in optical limiting fibers, spillover results included making fiber-based light-sources, writing holograms in fibers, and developing the theory of the limits of the nonlinear-optical response, which has direct impact on understanding structure- property relationships in the development of new molecules. Highlights are presented in the technical report. More details can be found in our published papers.
DTIC
Polymers; Photorefractivity

20030109332 Washington Univ., Seattle, WA
Investigation of Rapid Pressurization Techniques for the Ram Accelerator
Bruckner, Adam P.; Knowlen, Carl; Oct. 13, 2003; 62 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-O1-1-0991
Report No.(s): AD-A417707; AERP-20031013-62-5615; No Copyright; Avail: CASI; A04, Hardcopy

This research program demonstrated that flared-cup diaphragms made from polycarbonate can be shot down a smooth bore tube and that they form a tight pressure seal wherever they come to rest. Control of the stopping position was achieved by shooting the cup diaphragm with excess velocity into a tube insert that had serrated ridges formed by cutting annular

grooves inside the tube walls. The combination of internal pressurization and spring tension forces pushed the walls of the cup diaphragm deeply into the grooves of the insert which abruptly stopped the diaphragm movement and formed a good pressure seal. Live-fire ram accelerator experiments showed that projectiles with magnesium nose tips can readily penetrate the thick-walled polycarbonate diaphragms without any impact on ram accelerator performance, and that the diaphragm fragments are completely blown out of the catcher insert every time. These experimental results demonstrated that a breech-loaded diaphragm system can be readily implemented.
DTIC
Ram Accelerators; Polycarbonates; Pressurizing; Research Projects

28
PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

20030108436 Air Force Research Lab., Edwards AFB, CA, USA
Isolation of Boron and Carbon Atoms in Cryogenic Solids
Larson, C. W.; Aug. 21, 2003; 15 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A417016; AFRL-PR-ED-VG-2003-212; AFRL-PR-ED-VG-2003-212; No Copyright; Avail: CASI; A03, Hardcopy

Theoretical Isp of cryogenic solid propellants composed of the atoms, dimers and trimers of lightweight elements isolated in solid para hydrogen. Consequences of condensation; Spectroscopic studies of Boron/Carbon clusters by matrix isolation spectroscopy; Development of stable, hi-flux boron atom source for preparation of cryogenic solid HEDM (under auspices of Small Business Innovative Research (SBIR) program; First optical spectrum of B3 (under auspices of International Research Initiative of the Air Force Office of Scientific Research).
DTIC
Cryogenic Rocket Propellants; Isolation; Solid Propellants; Spacecraft Propulsion

20030108437 Air Force Research Lab., Edwards AFB, CA, USA
Isolation of Boron and Carbon Atoms in Cryogenic Solids
Larson, C.W.; Aug. 13, 2003; 9 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A417017; AFRL-PR-ED-TP-2003-207; AFRL-PR-ED-TP-2003-207; No Copyright; Avail: CASI; A02, Hardcopy

Boron and carbon atoms, and their dimmers and trimers were isolated in solid argon by co-condensation of their vapors onto a substrate maintained at 10 K. Growth and disappearance of various clusters with 3 to 12 atoms that occurred during annealing was studied by quantitative Fourier Transform Infrared Spectroscopy. The annealing experiments indicated that the initially formed solids contained about 80% B and C atoms and BC molecules. At 5 mole percent atom concentration these High Energy Density Materials (HEDM) could be applied in propulsion where they are capable of producing about 25% higher specific impulse than the best rocket engines fueled by liquid hydrogen and liquid oxygen
DTIC
Propulsion; Solid Propellants; Cryogenic Rocket Propellants

20030108447 Indiana Univ., Bloomington, IN, USA
JP8+100 Jet Fuel Toxicity: Proteomic Analysis
Witzmann, Frank A.; Apr. 30, 2003; 22 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0153
Report No.(s): AD-A417098; AFRL-SR-AR-TR-03-0324; No Copyright; Avail: CASI; A03, Hardcopy

This final technical report describes the results of experiments that were undertaken to analyze the effect of JP8 jet fuel exposure by aerosol/vapor on quantitative and qualitative gene expression in rodent tissues. The stated objectives were to 1) generate gene expression databases for some of the major rodent target tissues, 2) identify as many of the affected gene products as possible, and 3) apply the observed molecular alterations to elucidating JP8's multifaceted toxicity. As a result of

our efforts we have determined that both acute and chronic JP8 exposure significantly alters protein expression in a range of target organs, even after a period of recovery, and that these changes correspond to histological observations in those organs. Furthermore, the protein alterations observed in rats and mice are suggestive of potential hazard when extrapolated to humans.
DTIC
Toxicity; Jet Engine Fuels; Organs

31
ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20030108402 Air Force Research Lab., Edwards AFB, CA, USA
Comparison of Force Balance Calibration Techniques for the Nano-Newton Range
Selden, Nathaniel P.; Ketsdever, Andrew D.; Jul. 31, 2003; 25 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A417221; AFRL-PR-ED-TP-2003-199; No Copyright; Avail: CASI; A03, Hardcopy

With the rapid progress of micro- and nano-scale fabrication technology, devices are continually being created which produce extremely small forces. This creates a distinct need for a measurement instrument and adequate calibration techniques which can resolve forces below 1 micro N. Two calibration methods for force balance measurements in the nano- Newton range are presented. These methods are based on a free molecule, gas dynamic expansion through a thin-walled orifice and the electrostatic actuation of a miniature comb drive. Due to the advantages and disadvantages of every calibration technique, multiple techniques are often required to validate performance results for micro-scale devices. Because these calibration techniques typically rely on completely different physical processes and can be described by different sets of analytical equations, the comparison of one technique to another is necessary when high accuracy is required. The gas dynamic and electrostatic force calibration techniques have been compared and were found to agree to within 8% for force levels between 35 nano-Newtons and 1 micro N.
DTIC
Calibrating; Electrostatics; Force Distribution

20030108761 Defence Science and Technology Organisation, Victoria, Australia
Calibration of the Flow in the Extended Test Section of the Low-Speed Wind Tunnel at DSTO
Erm, Lincoln P.; Jan. 2003; 134 pp.; In English
Report No.(s): AD-A417291; DSTO-TR-1384; DODA-AR-012-551; No Copyright; Avail: CASI; A07, Hardcopy

In 1996, the circuit of the low-speed wind tunnel was modified by extending the length of the test section and installing a redesigned contraction. This was done to enable longer models to be tested in the tunnel and also to possibly obtain some improvement in the quality of the flow in the test section. In this report, the results are given of a detailed calibration of the flow in the extended test section of the tunnel. The calibration was performed to: (1) provide a data base of the flow quality, to be used when analysing tests carried out in the tunnel since 1996, and (2) provide a data base for assessing the changes in the flow quality resulting from installing the extended test section and new contraction in 1996. Longitudinal mean-flow velocities, flow angles, turbulence intensities and spectra, were measured at up to 155 grid points across the flow for longitudinal positions of X(TAU) = -2.0, -1.0, 0.0 and +1.0 m from the centre of the turntables in the test section for nominal free-stream velocities of 30, 45, 60 and 75 m/s. The most important area of the test section, where models are usually located, is the region comprising approximately the central 50% of the cross sectional area of the test section. In this region, over the longitudinal measurement range (X(TAU) = -2.0 to +1.0 m), the following flow non-uniformities were observed. For the four velocities, longitudinal mean-flow velocities deviated within the range -1.2% to +1.6% from their values at the centre of the tunnel test section (X(TAU) = 0.0 m). For velocities of 30 and 60 m/s, horizontal flow angles deviated within the range - 0.8 deg. to +0.8 deg. and vertical flow angles deviated within the range -1.2 deg. to +0.4 deg.. For velocities of 30 and 60 m/s, the u-component turbulence intensities were generally below 0.4%, and the v- and w-component intensities were generally below 0.7%.
DTIC
Wind Tunnel Tests; Calibrating; Computational Grids; Low Speed

20030108764 Army Research Inst. Field Unit, Orlando, FL, USA

Virtual Environments for Dismounted Soldier Simulation, Training, and Mission Rehearsal: Results of the FY 2002 Culminating Event

Knerr, Bruce W.; Lampton, Donald R.; Thomas, Mark; Corner, Brian D.; Grosse, James R.; Sep. 2003; 120 pp.; In English

Contract(s)/Grant(s): Proj-A790

Report No.(s): AD-A417360; ARI-TR-1138; No Copyright; Avail: CASI; A06, Hardcopy

This report describes the activities and results of the final year culminating event (CE) of the 'Virtual Environments for Dismounted Soldier Simulation, Training and Mission Rehearsal' Science and Technology Objective (STO). This STO was conducted jointly by the U.S. Army Research Institute, the U.S. Army Simulation, Training, and Instrumentation Command (STRICOM), and the U.S. Army Research Laboratory. This four-year effort (FY99-FY02) was focused on overcoming critical technological challenges that prevented high fidelity dismounted soldier simulation. The objectives of the CE were to integrate and evaluate the technologies developed during the year. The key technologies included: a Dismounted Infantry Virtual After Action Review (AAR) System; new behaviors and improved operator control for Dismounted Infantry Semi-Automated Forces (DISAF); soldier control of DISAF through Voice Recognition and Synthesis; enhancements to the soldier simulator, the Soldier Visualization Station (SVS); and a dynamic terrain server. The CE provided a realistic and challenging test of the systems and capabilities under development. The results include lessons learned, feedback from soldiers obtained by questionnaires and group interviews, and observer rating of leader and squad performance. Technological developments over the course of the STO greatly increased the variety and realism of the training situations that could be presented and leader ratings of training effectiveness. Both leader self-ratings and performance scores indicate that soldier skills improved with practice in VE.

DTIC

Virtual Reality; Systems Simulation; Education

20030108765 Air Force Research Lab., Brooks AFB, TX, USA

Windblast Facility Evaluation

Pellettlere, Joseph A.; Nguyen, Thao Q.; Nguyen, Charles C.; Feb. 2003; 47 pp.; In English

Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A417363; AFRL-HE-WP-TR-2003-0060; No Copyright; Avail: CASI; A03, Hardcopy

The windblast test facility at Dayton T. Brown (DTB) was recently reconstructed with several modifications. These modifications were aimed at improving airflow uniformity and increasing the effective blast area. AFRL has routinely used the facility at DTB in its research programs and collaborated with DTB on the evaluation of the facility upgrades. Fifty-two windblast tests were conducted with airspeeds ranging from 375-725 Knots Equivalent Airspeed (KEAS). During these tests the flow at the location of where test articles would be placed was measured. The resulting flow was used to calculate the velocity decay from the windblast nozzle to the test article as well as determine the airflow uniformity across the test article space. It was determined that the airflow was uniform and the system was capable of producing a 700 KEAS blast.

DTIC

Air Flow; Evaluation; Test Facilities; Blast Loads

32
COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and *17 Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see *03 Air Transportation and Safety*; and *16 Space Transportation and Safety*.

20030108381 Army Aeromedical Research Lab., Fort Rucker, AL

Analysis of Head Motion in Rotary-Wing Flight Using Various Helmet-Mounted Display Configurations (Part 3. Roll)

Stelle, Jessica A.; Rostad, Ryan J.; Rash, Clarence E.; Crowley, John S.; Aug. 2003; 140 pp.; In English

Report No.(s): AD-A417296; USAARL-2003-13-PT-3; No Copyright; Avail: CASI; A07, Hardcopy

In spite of an immense increase in interest in helmet-mounted displays (HMDs) over the past two decades, there have been few studies on head motion while using HMDs in operational flight. Rotary-wing flight conducted using a number of HMD configurations has resulted in a head position database that will be useful in filling this void. Various analysis techniques have been applied to investigate characteristics of roll (tilt) head position distributions for a slalom flight maneuver for four visual

environments: good visual environment (daytime, unaided), night vision goggles, HMD with thermal imagery, and HMD with thermal imagery and symbology.
DTIC
Attitude (Inclination); Helmet Mounted Displays; Aircraft Maneuvers

20030108386 Range Commanders Council, White Sands Missile Range, NM
Standard Electronic Attack Clearance Request for Ranges
Nov. 2002; 32 pp.; In English
Report No.(s): AD-A417330; IRIG STANDARD-703-02; No Copyright; Avail: CASI; A03, Hardcopy

Electronic Attack (EA), formerly known as Electronic Countermeasures (ECM), includes both electronic jamming and chaff dispensing operations. EA is a subdivision of Electronic Warfare, which also consists of Electronic Protection (EP) and Electronic Warfare Support (ES). EA in the USA is an important element of DOD weapons systems testing and military training. The purpose of this document is to furnish guidance on the procedures for obtaining EA clearance for operations on U.S. ranges and within adjoining areas of restricted military air space. EA operations often require the sharing of bands used or controlled by other agencies. Because of the disruptive nature of EA and the serious consequences of uncontrolled EA on safety-of-life systems such as air and sea navigation and air-traffic control, special coordination requirements have been instituted for obtaining EA authorization. Agencies of major concern are the Federal Communication Commission (FCC), which has jurisdiction over commercial and private spectrum operations, and the Federal Aviation Administration (FAA), which regulates flight safety. EA may be performed only under the condition that it not cause harmful interference to other authorized users of the spectrum, especially to safety-of-life systems such as air-traffic control and air/sea radio-navigation systems. Specific procedures for coordinating and obtaining authorization for Electronic Attack have been developed in formal agreements between Department of Defense (DOD) and other federal agencies and are documented and disseminated via the Chairman of the Joint Chiefs of Staff Manual CJCSM 32l2.02A, dated 11 Mar 02, titled Performing Electronic Attack in the US. and Canada for Tests, Training and Exercises. A memo outline and instructions for requesting electronic attack clearance, on and around U.S ranges, are included in Appendix B.
DTIC
Electronic Warfare; Electronic Countermeasures; Guidance (Motion); Jamming; Radio Navigation

20030108399 Defense Science Board, Washington, DC, USA
Wideband Radio Frequency Modulation: Dynamic Access to Mobile Information Networks
Jul. 2003; 107 pp.; In English
Report No.(s): AD-A417214; No Copyright; Avail: CASI; A06, Hardcopy

Radio communications is in worldwide flux. There are pressures from the commercial sector for additional frequency spectrum to provide new services; there is significant demand from the Department of Defense (DoD) to increase communications capacity around the world and in multiple contexts/environments; and there are multiple proposals for innovative radio architectures that promise greatly enhanced radio frequency capacity. This report discusses these aspects and presents a set of recommendations aimed at moving in a comprehensive manner to a coherent communications system for the Department of Defense.
DTIC
Frequency Modulation; Mobile Communication Systems; Radio Frequencies

20030108672 Range Commanders Council, White Sands Missile Range, NM
Test Methods for Telemetry Systems and Subsystems. Volume 1. Test Methods for Vehicle Telemetry Systems
Apr. 2003; 244 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417234; RCC/TG-118-03; No Copyright; Avail: CASI; A11, Hardcopy

A telemetry system measurement begins with the sensing of a measurand by a transducer located either on a test vehicle or at a remote test site. It ends at a data storage/display device located at a receiving test site. Systems interconnected by radio links, direct wiring or electro-optical means, or any combination, are included. To ensure that data is of the highest possible quality, individual components should be tested and calibrated in a suitable laboratory before installing the system. Subsequently, the telemetry system should be subjected to a carefully conducted end-to-end calibration check just before, during, and immediately after the actual test. This document is intended to address general methodologies and techniques, and no attempt has been made to cover all possible cases.
DTIC
Telemetry; Detection; Systems Engineering; Test Vehicles; Methodology

20030108962 Naval Postgraduate School, Monterey, CA, USA
A Strategic Market Analysis of the Open Market Corridor
Clark III., John H.; Tucker, Joshua L.; Jun. 2003; 69 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417422; No Copyright; Avail: CASI; A04, Hardcopy

The purpose of the MBA Project was to perform an analysis of the market and environment of Government and commercial e-commerce opportunities in order to identify key stakeholders critical issues and an overall marketing strategy for the Open Market Corridor. Through comprehensive literature review and information gathering a focused analysis of a specific potential customer Naval Supply Systems Command (NAVSUP) is conducted to highlight the threats and opportunities to the system.

DTIC
Marketing; Electronic Commerce; Strategy

20030109072 Princeton Univ., NJ, USA
Advanced Signal Processing for Multiple Access Communications Systems
Poor, H. V.; Sep. 29, 2003; 6 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0141
Report No.(s): AD-A417402; No Copyright; Avail: CASI; A02, Hardcopy
Signal Processing; Communication

20030109089 Air Force Inst. of Tech., Wright-Patterson AFB, OH
A Communications Modeling System for Swarm-Based Sensors
Kadrovach, Brian A.; Sep. 2003; 252 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417458; AFIT/DS/ENG/03-03; No Copyright; Avail: CASI; A12, Hardcopy

Today's information age has exploded the amount of data available to decision makers at all levels of the control hierarchy. The miniaturization and proliferation of sensor technology has enabled extensive detection and monitoring and advances in computational capabilities have provided for embedded data analysis and the generation of information from raw data. Additionally, with the miniaturization of mechanical systems it is possible to provide platforms for sensor suites that are capable of mobility and limited autonomy. Swarming or bio-emergent behavior problems,provides a robust scalable mechanism for organizing large numbers of mobile sensor platforms. However, the mobility dynamics of swarm systems present additional challenges. This research develops a novel ad hoc data network communications modeling methodology for swarm-based sensor systems that provides a process for evaluating performance of communications protocols with respect to swarm dynamics parameter-based swarm simulation system based on innovative vision models is developed and used to investigate and characterize swarm behavior. The process allows for communications protocol evaluations in the context of dynamic swarm behaviors. Three network communications protocols are presented for swarm-based sensor networks and a performance comparison is made. The three protocols-Directed Diffusion, Geographical Routing Protocol, and Flooding Protocol are compared. Results indicate, for the degree of mobility investigated, that the Directed Diffusion protocol slightly outperforms the Geographical Routing Protocol system. The swarm network modeling process developed provides a new methodology for rigorous and repeatable investigation of network communications systems with respect to the complex dynamics of swarm-based sensor networks.

DTIC
Communication Networks; Multisensor Fusion; Applications Of Mathematics

20030109098 Naval Postgraduate School, Monterey, CA
The Use of Point-to-Point Lasers for Navy Ships
Bonk, Scott; Jun. 2003; 100 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417476; No Copyright; Avail: CASI; A05, Hardcopy

Currently the Navy uses microwave technology to wirelessly connect ships at sea. These systems provide approximately a 1.5Mb/s transfer rate and have some significant drawbacks. Microwave antennas provide a very large electromagnetic signature, require a large power source, and require a lot or support equipment and personnel to maintain connections. Laser technology can offer connection speeds 50 times greater than microwave, have no electromagnetic signature, use only a fraction of the space and power requirements, and require little to no personnel maintenance. Lasers offer many advantages to its microwave counterpart but it may also have some drawbacks. This paper addresses the effects inclement weather will have on range and bandwidth. Weather ranging from log to heavy rain also is analyzed in relation to the current system. Aside

from communications between ships, lasers offer other untouched tactical benefits including -enhanced communications between ships and remote controlled drones. Unmanned vehicles could provide full motion video, telemetry, atmospheric conditions, and provide an uplink for smaller water or land based terminals to the ship.
DTIC
Laser Applications; Microwave Antennas

20030109109 Naval Postgraduate School, Monterey, CA
Operational Benefit of Implementing VoIP in a Tactical Environment
Lewis, Rosemary; Jun. 2003; 78 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417571; No Copyright; Avail: CASI; A05, Hardcopy

In this thesis, Voice over Internet Protocol (VoIP) technology will be explored and a recommendation of the operational benefit of VoIP will be provided. A network model will be used to demonstrate improvement of voice End-to-End delay by implementing quality of service (QoS) controls. An overview of VoIP requirements will be covered and recommended standards will be reviewed. A clear definition of a Battle Group will be presented and an overview of current analog RF voice technology will be explained. A comparison of RF voice technology and VoIP will modeled using OPNET Modeler 9.0.
DTIC
Protocol (Computers); Radio Frequencies; Internets

33
ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20030108380 Michigan Univ., Ann Arbor, MI
Seven-Segment Organic Polymer Based Light-Emitting Devices on Plastic Substrates
Kanicki, Jerzy; Oct. 13, 2001; 109 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-99-1-0958
Report No.(s): AD-A417256; No Copyright; Avail: CASI; A06, Hardcopy

Organic polymer red light-emitting devices (OPLEDs) with the double layer structure have been fabricated on flexible plastic substrates. Dow red emissive polymer and poly (3,4-ethylenedioxythiophene)/poly (styrene) (PEDOT/PSS) have been used as an emissive and a hole injection polymer, respectively. The spin coating technique was used to deposit different polymers. The absorption and the cyclic voltammetry spectra have been used to construct the band diagram of our OPLEDs. The following electrical and optical properties have been obtained for our OPLEDs: turn-on voltage, defined at 1 cd/m(squared) = 3.0 V; voltage and current density defined at 100 cd/m(squared) = ^6.5 V and ^34 mA/c(squared) maximum emission efficiency = = ^0.25 cd/A; and maximum luminous efficiency = ^0.1 lm/W. The extrapolated lifetime of unpackaged OPLEDs on flexible plastic substrate of about 1160 min for initial brightness of 100 cd/m(squared) has been obtained.
DTIC
Substrates; Plastics; Display Devices; Conducting Polymers

20030108514 Massachusetts Inst. of Tech., Lexington, MA
EHF Satellite Communications on the Move: Experimental Results
Schodorf, J. B.; Aug. 15, 2003; 108 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A417222; TR-1087; ESC/MA-TR-2003-051; No Copyright; Avail: CASI; A06, Hardcopy

This report summarizes the results of experiments conducted with an EHF SATCOM on the move (SOTM) terminal developed to work with LDR MILSTAR. The experiments were designed to measure characteristics of the EHF SOTM propagation channel, yield insight into the performance of an automatic repeat request error control protocol, and assess the pointing performance of the system's antenna positioner. With respect to the propagation experiments, the report contains statistical analyses of the data that yield probability density models for the received signal power, fade and nonfade duration distributions, and estimates of level crossing rates. Discrete models for the EHF SOTM channel are also explored and compared to the measured data. Results from the protocol experiments include packet error rate, throughput efficiency and packet latency as a function of protocol parameters (e.g., packet length) and channel conditions. As with the propagation

experiments, the report contains analyses of the antenna pointing data recorded during the positioner experiments that result in statistical models for the LOS error under various terrain conditions.
DTIC
Antennas; Satellite Communication

20030108633 Massachusetts Inst. of Tech., Cambridge, MA
Effect of Radiation on Silicon and Borosilicate Glass
Allred, Clark L.; Sep. 2003; 255 pp.; In English
Contract(s)/Grant(s): CI02-1279
Report No.(s): AD-A417276; No Copyright; Avail: CASI; A12, Hardcopy

A study was made that is logically divided into two parts, both involving radiation damage effects. The first is a study of the effects of neutron and gamma radiation on the dimensions of two borosilicate glasses, pyrex and Hoya SD- 2. These two glasses are commonly used as substrates for silicon microelectromechanical (MEMS) devices, and radiation- induced compaction in a substrate can have deleterious effects on device performance. Results are presented for density changes induced in both glasses by neutron irradiation. Pyrex was shown to compact at a rate of (in Gamma p/p per n/sq cm) 8. 14 x 1O(exp -20) (thermal) and 1.79 x 1O(sub -20) (fast). The corresponding results for Hoya SD-2 were 2.21 x 1O(sub -21) and 1.71 x 10(sub-21), respectively. On a displacement per atom (dpa) basis, the compaction of the Pyrex was an order of magnitude greater than that of the Hoya SD-2. Our results are the first reported measurement of irradiation-induced densification in Hoya SD-2. The compaction of Pyrex agreed with a previous study. Our results for gamma irradiations were unexpected. Silicon MEMS strain gauges mounted on glass wafers were gamma-irradiated to hundreds of Mrad. Based on expectations from the literature, the Pyrex was supposed to compact to a level easily measurable by the MEMS strain gauges. Almost no substrate compaction registered in the strain gauges, however. It is hypothesized that the anodic bonding process (by which a silicon wafer was bonded to the glass before etching to create the MEMS strain gauges) was responsible for either 1) changing the bulk radiation response of the glass or 2) creating a layer near the bond interface which somehow prevented the MEMS strain gauges from registering the compaction that was occurring in the glass substrate.
DTIC
Nuclear Radiation; Glass; Silicon; Radiation Damage

20030108683 Naval Postgraduate School, Monterey, CA
An Evaluation of Electric Motors for Ship Propulsion
Bassham, Bobby A.; Jun. 2003; 117 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417341; No Copyright; Avail: CASI; A06, Hardcopy

An evaluation was conducted of the various propulsion motors being considered for electric ship propulsion. The benefit of such an evaluation is that all of the propulsion options being considered by the U.S. Navy have been described in one document. The AC induction motor, AC synchronous motor, High Temperature Superconducting (HTS) motor and Superconducting DC Homopolar Motor (SDCHM) are examined. The properties, advantages, and disadvantages of each motor are discussed and compared. The power converters used to control large propulsion motors are also discussed. The Navy's IPS program is discussed and the results of concept testing are presented. Podded propulsion is introduced and the benefits are discussed. The final chapter presents the simulation results of a volts/Hertz controlled 30 MW induction motor. The evaluation revealed that the permanent magnet motor is the best propulsion motor when considering mature technology, power density, and acoustic performance. HTS motors offer significant volume reductions and improved acoustic performance as compared to conventional motors. This includes both AC and DC HTS motors. The main obstacle for the SDCHM remains the unavailability of high current capacity brushes.
DTIC
Electric Motors; Marine Propulsion; Evaluation; Ships; Propulsion

20030108687 Case Western Reserve Univ., Cleveland, OH
Magneto-Optical Properties of Hybrid Magnetic Material Semiconductor Nanostructures
Lambrecht, Walter R.; Aug. 2003; 7 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0880
Report No.(s): AD-A417362; No Copyright; Avail: CASI; A02, Hardcopy

Calculations were performed of the formation energies of transition metal carbides and silicides in order to evaluate the thermodynamic limitations to incorporation of these elements as dopants in Silicon carbide. The prospects of SiC as a host

for dilute magnetic semiconductor applications by doping with Cr and Mn were evaluated. Calculations were performed for MnN and Mn3N2 compounds and a model developed for explaining their anti ferromagnetic order in terms of exchange interactions between near neighbors. Densities of states calculations of these materials were used to interpret spin-polarized scanning tunneling microscopy data. Calculations were performed for FeN in zincblende and rocksalt structure to compare their relative stability and magnetic properties. Calculations of the preference for ferro or anti ferromagnetic coupling were performed for GdN. Program development work on magneto- optics and methods beyond LDA was initiated.
DTIC
Magneto-Optics; Semiconductors (Materials); Silicon Carbides; Ferromagnetic Materials; Metal Compounds; Magnetic Materials

20030108739 Naval Undersea Warfare Center, Newport, RI
Antenna for Deployment from Underwater Location
Rivera, David F., Inventor; Jun. 16, 2003; 41 pp.; In English
Patent Info.: Filed 16 Jun. 2003; US-Patent-Appl-SN-10463907
Report No.(s): AD-D020088; No Copyright; Avail: Other Sources

A slotted antenna comprises a plurality of loop structures and interconnecting conductors that define a slot. The antennas can operate in a single band or over multiple bands. Flexible or inflatable substrates enable easy storage aboard an underwater craft and facilitate deployment and towing behind an underwater craft with minimal chances of detection.
DTIC
Slot Antennas; Broadband

20030108916 Naval Postgraduate School, Monterey, CA
An Experimental Study of High Heat Flux Removal Using Micro-Droplet Spray Cooling
Cryer, Matthew A.; Jun. 2003; 61 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417423; No Copyright; Avail: CASI; A04, Hardcopy

Recent studies have shown that thermophotovoltaic (TPV) technology is a promising source of high power density generation. Enhanced TPV systems can theoretically provide power densities of up to 100 W/sq cm. The inherent inefficiencies in the system dictate that up to 90% of that energy is not converted to electrical power, and must be removed as waste heat to ensure that the components are maintained at a reasonable operating temperature. The present study addresses this issue by investigating the suitability of using spray cooling techniques to remove heat generated by power densities of up to 100 W/sq cm. A simple, scaleable experiment was designed using low cost commercially available components to study the effects that spray mass flux and droplet size have on the heat removal capacity of the system. A series of nozzles were used so that mass flux and droplet size could be studied independently, giving high resolution to the data so that predictive correlations could be developed over the range of parameters varied in the study.
DTIC
Energy Conversion; Heat Flux; Photovoltaic Effect; Experimentation; Removal; Electric Power Supplies; Sprayers

20030109058 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Methods to Account for Accelerated Semi-Conductor Device Wearout in Longlife Aerospace Applications
Walter, Joerg D.; Jan. 2003; 126 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417647; No Copyright; Avail: CASI; A07, Hardcopy

The aerospace industry is concerned that as semiconductor feature sizes are reduced future technology generations, device lifetime will decrease as well. Inherent device failure mechanisms, such as electromigration, hot carrier effects and time dependent dielectric (oxide) breakdown, may lead to shorter lifetimes at these smaller feature sizes. Many longlife aerospace applications must use commercially available off-the-shelf devices. The reliability margins in future devices may be decreased as semiconductor suppliers trade performance for reliability to meet the requirements of their core markets. If the lifetime of future devices proves to be inadequate for longlife aerospace applications, operating them at a derated stress condition can extend their lifetime. This is accomplished by reducing the operating voltage of the devices.
DTIC
Aerospace Engineering; Reliability; Service Life; Semiconductor Devices; Aerospace Environments

20030109066 Maryland Univ., College Park, MD

Non-Destructive Evaluation of Defects in Wires and Other Samples Using an 8-Channel High-Tc Scanning SQUID Microscope

Wellstood, Fred; Lee, Su-Young; Gilbertson, Anders; Matthews, John; Moore, Greg; Aug. 26, 2003; 11 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0062; Proj-528353

Report No.(s): AD-A417448; AFRL-SR-AR-TR-03-0345; No Copyright; Avail: CASI; A03, Hardcopy

This project involves the development, construction, and operation of a sensitive magnetic microscope that is based on the dc Superconducting QUantum Interference Device (SQUID). During this project the authors constructed a system by modifying one of an existing 1-channel liquid- nitrogen cooled SQUID microscope to hold an array of 8 high-Tc YBCO SQUIDs. The SQUID chip was mounted on the end of a 77 K cold finger in the vacuum space of a dewar that has a thin (25 micrometer) window that separates the vacuum from room temperature air. The system will mainly be used to image yields, voids, and occlusions in Cu-clad NbTi superconducting magnet wires and in high-Tc superconducting wire samples, with the aim being to provide reliable detection of defects that cause reduced critical current. In the last six months of the project (September 2002 to the extended ending date of March 2003), there were three main tasks that needed to be completed. The first task was to complete the software for reading out and controlling multiple SQUIDS. The controlling software was rewritten, and now simultaneous data can be taken for two SQUIDS. The second task was to compare system performance to a flow-through SQUID system that was under development for testing long sections of wires. The last task for the system was to reinstall a chip with up to 8 working SQUIDs. The chip the author had used for the last year and a half started with seven working devices, but damage had accumulated (i.e., broken wire bonds, junction failure, and damage that was incurred when the thin window broke) and only two devices are presently working on the chip. However, a back-up chip is available with about 6 operating SQUIDs on it, and the author expects to swap out the existing chip in the next few months.

DTIC

Wire; Chips (Electronics); Diagnosis; High Temperature Superconductors; Failure; Magnets; Squid (Detectors)

20030109068 Yale Univ., New Haven, CT

Construction of a Reactive Co-Evaporation Oxide Thin Film Deposition System

Ahn, Charles; Aug. 28, 2003; 5 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0210; Proj-3484

Report No.(s): AD-A417449; AFRL-SR-AR-TR-03-0346; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this research program is to develop a Molecular Beam Epitaxy (MBE) system adapted to the growth and characterization of complex oxide films. The research focus is on the epitaxial growth of complex oxides, such as SrTiO3 and BaTiO3, on single crystal silicon and complex oxide substrates. This task leads to a number of requirements for this system: 10000 C substrate temperature to remove SiO2 from Si wafers in situ; angstrom per minute deposition rates to accurately synthesize unit cell buffer layers; high-resolution reflection, high-energy electron diffraction (RHEED) to characterize surface structure; and an oil-free pumping system to avoid contamination. (1 figure)

DTIC

Thin Films; Epitaxy; Field Effect Transistors

20030109080 Air Force Research Lab., Edwards AFB, CA, USA

Data Presentation

Merrell, Joseph; Aug. 11, 2003; 38 pp.; In English

Contract(s)/Grant(s): Proj-CIA0

Report No.(s): AD-A417414; AFRL-PR-ED-TP-2003-200; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available

Data Management; Data Acquisition; Pressure Sensors

20030109090 Naval Postgraduate School, Monterey, CA

Genetic Algorithm Design And Testing of a Random Element 3-D 2.4 Ghz Phased Array Transmit Antenna Constructed of Commercial Rf Microchips

Esswein, Lance C.; Jun. 2003; 135 pp.; In English; Original contains color illustrations

Report No.(s): AD-A417460; No Copyright; Avail: CASI; A07, Hardcopy

The USA Navy requires radical and innovative ways to nodal and design multifunction phased array radars. This thesis puts forth the concept that Genetic Algorithms, computer simulations that mirror the natural selection process to develop

creative solutions to complex problems, would be extremely well suited in this application. The capability of a Genetic Algorithm to predict adequately the behavior of an array antenna with randomly located elements was verified with expected results through the design, construction, development and evaluation of a test-bed array. The test-bed array was constructed of commercially available components, including a unique and innovative application of a quadrature modulator microchip used in commercial communications applications. Corroboration of predicted bean patterns from both Genetic Algorithm and Method of Moments calculations was achieved in anechoic chaster measurements conducted with the test-bed array. Both H-plane and E-plane data runs were made with several phase steered beans. In all cases the measured data agreed with that predicted from both modeling programs. Although tine limited experiments to bean forming and steering with phase shifting, the test-bed array is fully capable of bean forming and steering though both phase shifting and aptitude tapering.
DTIC
Computerized Simulation; Antennas

20030109104 Naval Postgraduate School, Monterey, CA
Design and Development of a Configurable Fault- Tolerant Processor (CFTP) for Space Applications
Ebert, Dean A.; Jun. 2003; 248 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417502; No Copyright; Avail: CASI; A11, Hardcopy

The harsh radiation environment of space, the propensity for SEUs to perturb the operations of a silicon based electronics, the rapid development of microprocessor capabilities and hence software applications, and the high cost (dollars and time) to develop and prove a system, require flexible, reliable, low-cost, rapidly-developed system solutions. Consequently, a reconfigurable Triple Modular Redundant (TMR) System-on-a-Chip (SOC) utilizing Field Programmable Gate Arrays (FPGAs) provides a viable solution for space based systems. The Configurable Fault Tolerant Processor (CFTP) is such a system, designed specifically for the purpose of testing and evaluating, on orbit, the reliability of instantiated TMR soft-core microprocessors, as well as the ability to reconfigure the system to support any on board processor function. The CFTP maximizes the use of Commercial Off-The-Shelf (COTS) technology to investigate a low-cost, flexible alternative to processor hardware architecture, with a Total Ionizing Dose (TID) tolerant FPGA as the basis for a SOC. The flexibility of a configurable processor, based on FPGA technology, will en- able on-orbit upgrades, reconfigurations, and modifications to the architecture in order to support dynamic mission requirements. The CFTP payload consists of a Printed Circuit Board (PCB) of 5.3 inches x 7.3 inches utilizing a slightly modified PC/104 bus interface. The initial FPGA configuration will be an instantiation of a TMR processor, with included Error Detection and Correction (EDAC) and memory controller circuitry. The PCB is designed with requisite supporting circuitry including a configuration controller FPGA, SDRAM, and Flash memory in order to allow the greatest variety of possible configurations. The CFTP is currently manifested as a Space Test Program (STP) experimental payload on the Naval Postgraduate School's NPSAT1 and the USA Naval Academy's MidSTAR-1 satellites.
DTIC
Aerospace Environments; Computer Programming; Logic Circuits; Fault Tolerance

20030109106 International Wire and Cable Symposium, Inc., Eatontown, NJ, USA
Proceedings of the 51st IWCS/Focus International Wire and Cable Symposium
Nov. 2002; 794 pp.; In English
Report No.(s): AD-A417493; No Copyright; Avail: CASI; A99, Hardcopy

The International Wire and Cable Symposium provides a forum for the exchange of technical information amongst suppliers, manufacturers, and users on technological advancements in materials, processes, and products used for voice, data and video signal transmission systems. The papers in this volume were printed directly from unedited reproducible copies prepared by the authors.
DTIC
Conferences; Telecommunication

20030109164 Massachusetts Univ., Amherst, MA
An Interconnect-Centric Approach for Adapting Voltage and Frequency in Heterogeneous System-on-a-Chip
Laffely, Andrew J.; Sep. 29, 2003; 186 pp.; In English
Report No.(s): AD-A417581; CI02-1288; No Copyright; Avail: CASI; A09, Hardcopy

This dissertation proposes a power-aware SoC design methodology, which is characterized by four key elements. First, SoC infrastructure is developed specifically to create modularity in both the physical floor plan, and application. Second, a statically scheduled interconnect approach eases physical design, limits network overhead, and assures predictable

interconnect behavior. This interconnect approach is well suited for signal processing applications critical to portable electronics, including video and speech coding, graphics, and cryptography. Third, system modularity is exploited for power savings by allowing the independent development and use of reconfigurable processing cores. Dynamic parameterization is proposed as a formalism for run- time reconfiguration of these cores. Finally, interconnect behavior monitoring is used to estimate core utilization and control individual voltage and frequency scaling for each core.
DTIC
Electric Potential; Chips (Electronics); Heterogeneity

20030109323 State Univ. of New York, Buffalo, NY
Short-Data-Record Adaptive Receivers for Rapidly Changing Communications Environments
Batalama, Stella N.; Pados, Dimitris A.; Sep. 2003; 112 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0176
Report No.(s): AD-A417694; AFRL-SR-AR-TR-03-0405; No Copyright; Avail: CASI; A06, Hardcopy

We defined and pursued a novel line of research that lies in a multidisciplinary intersection of Estimation Theory, Communications Theory, and Mean-Square optimum linear filtering. Consider an arbitrary input signal vector space and a given information bearing signal vector to be protected or recovered in the presence of multiuser or other forms of heavy interference. Based strictly on statistical conditional optimization principles, we developed an iterative algorithm that starts from the conventional matched-filter correlator and generates a sequence of linear filters ('auxiliary-vecto?' filters) that converges to the exact MS-optimum solution. At each iteration step, the filter is given as a direct function of the input autocorrelation matrix, the signal vector waveform to be protected, and the filter at the previous iteration. When the autocorrelation matrix is sample-average estimated from a short data record, this procedure offers the means for effective control over the filter estimator bias versus (co-)variance trade-off. For a fixed data record size the filter estimators in this sequence have rapidly decreasing bias and gracefully increasing variance. They outperform other known estimators such as Sample-Matrix-lnversion (SMI), Diagonal-Loading (DL) SMI, RLS, LMS, reduced-rank eigenvector decomposition, and 'multistage' nested Wiener filter. While all of the above estimators converge to the optimum MMSE/MVDR solution for infinitely long data records, for any given finite data set there is at least one AV filter estimator in the sequence that outperforms all SMI, DL-SMI, RLS, LMS, reduced-rank eigenvector and multistage nested Wiener filter estimators. The theoretical and practical implications of these results are far reaching. Biased estimators and algorithms that offer fall control over the biasivariance balance are rarely reported in the literature, if any in a communications applicable context.
DTIC
Communication Theory; Receivers; Adaptive Control; Algorithms; Telecommunication

20030109356 Virginia Commonwealth Univ., Richmond, VA
Request for Mask Aligner and Upgrade for a Reactive Ion Etcher
Morkoc, Hadis; Jun. 14, 2003; 12 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0212; Proj-3484
Report No.(s): AD-A417759; AFRL-SR-AR-TR-03-0396; No Copyright; Avail: CASI; A03, Hardcopy

A mask aligner model Suss MJB3 UV/IR Mask Aligner to support our on going research was proposed for acquisition and the proposal was approved. An upgrade package for an RIB system was also proposed. However, due to limited funds only the funds for the mask aligner was made available. Consequently, the RIB upgrade portion of the proposed activity was not implemented. The mask aligner got ordered, received, and brought on line in June 2002 rapidly. It has been in use ever since and operating smoothly. The newest addition to the lithography equipment is a Karl Suss MJB3 mask aligner. Some of the features this model garnishes are UV 300 and liv 400 exposure source and front and back side illumination. The aligner is capable of producing about 0.5 j.tm line widths. Available front exposure and viewing, and back viewing allow alignment of the front patterns with respect to those on the back. The unit is either used by or support of research of some 25 researchers at VCU microelectronics center. A photograph of the exposure system is shown in Fig. 1.
DTIC
Etching; Ions

34
FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20030108521 Air Force Research Lab., Wright-Patterson AFB, OH
Three-Dimensional Hypersonic Boundary Layer Stability and Transition
Kimmel, Roger L.; Poggie, J.; Dec. 1997; 83 pp.; In English
Contract(s)/Grant(s): Proj-2307
Report No.(s): AD-A417303; WL-TR-97-3111; No Copyright; Avail: CASI; A05, Hardcopy

The stability and transition of three-dimensional boundary layers was studied. In the first phase of the investigation, arrays of hot film probes were used to measure the three-dimensional structure of instability waves on an axisymmetric cone at Mach 8. In the second phase, linear stability theory was used to design a cone with an elliptic cross section, which was also tested at Mach 8. Results show that disturbances on the axisymmetric cone travel in wave packets with predominantly zero wave angle. On the elliptic cone, only weak evidence for stationary waves was found. The predominant waves were traveling waves at about 12 kHz. Additional waves, probably second mode, occurred near 80 kHz.
DTIC
Boundary Layer Stability; Hypersonic Boundary Layer; Hypersonic Speed; Three Dimensional Boundary Layer; Boundary Layer Transition; Hypersonic Flow

20030108788 Naval Research Lab., Stennis Space Center, MS
Wave Bottom Boundary Layer Models for Smooth and Rough Beds
Puleo, Jack; Mouraenko, Oleg; Sep. 17, 2003; 22 pp.; In English
Report No.(s): AD-A417532; NRL/FR/7440--03-10053; No Copyright; Avail: CASI; A03, Hardcopy

Seven one-dimensional wave bottom boundary layer models have been analyzed based on different methods for estimating the turbulent eddy viscosity (laminar, linear, linear-exponential, parabolic. k-one-equation turbulence closure, k-epsilon-two-equation turbulence closure, and k- omega-two-equation turbulence closure). Two generic test cases displayed similar velocity profiles for all (he models with the exception of the laminar model. Boundary layer and sheer stress estimates, however, did show some differences. The linear and parabolic models predicted bed shear stress twice as large as the k-omega model and 25 percent larger than the k or k-epsilon models. Phase leads between the predicted bed shear stress and the free-stream velocity matched expectations with the laminar case leading by 45 degrees and the other models predicting a phase lead of the shear stress maxima between 12 and 18 degrees with respect to the free-stream velocity maximum. Comparisons to laboratory data on smooth and rough beds showed that overall the linear model was slightly more accurate than the parabolic linear-exponential. k, and k- omega models. The least accurate were the laminar and k- epsilon models. Based on the two laboratory simulations (forced by a 9.72-s sinusoidal wave form with an amplitude of 2 m s(-1)). it is shown that the extra computational effort required for the turbulence closure schemes does not afford an improvement in predictive capability in a one-dimensional boundary layer model. Therefore. it is recommended that the linear or parabolic model be used to rapidly determine flow characteristics for one-dimensional studies of the wave bottom boundary layer.
DTIC
Mathematical Models; Flow Characteristics; Free Flow; Boundary Layers; Prediction Analysis Techniques

20030108789 Woods Hole Oceanographic Inst., MA
Bounds on Turbulent Transport
Whitehead, John A.; Busse, Friedrich; Howard, Louis; Doering, Charles; Constantin, Peter; Jul. 2003; 332 pp.; In English
Contract(s)/Grant(s): N00014-97-1-0934; OCE-98-10647
Report No.(s): AD-A417533; WHOI-2003-06; No Copyright; Avail: CASI; A15, Hardcopy

The subject of 'Bounds on Turbulent Transport' was introduced in a series of ten lectures. The six lecturers constitute almost all of the contributors to this subject. The subject was introduced and foundations were laid by five lectures by F. H. Busse. In the middle of the first week, L. Howard reviewed his historical first approach to this subject and described more recent advances. Additional lectures by P. Constantine, R. Kerswell, C. Caulfield and C. Doering provided modern advances. We trust that the lecture notes will constitute a timely review of this promising subject. The following weeks had many highlights with approximately 40 additional lectures. The mini symposium on rotating convection in early July included presentations of experimental, ocean, atmospheric, and planetary observations. During the rest of the program, participants and visitors who have studied turbulence, convection, and instability in numerous geophysical situations with application to the

ocean, the earth's atmosphere and planetary circulation made numerous contributions.
DTIC
Geophysics; Fluid Dynamics; Lectures; Turbulence

20030109051 Pennsylvania State Univ., State College, PA
Basic Research in Thermoacoustic Heat Transport
Keolian, Robert M.; Atchley, Anthony A.; Sep. 2003; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-98-1-0212
Report No.(s): AD-A417390; No Copyright; Avail: CASI; A03, Hardcopy

Research in topics to improve the efficiency of thermoacoustic chillers and heat engines is summarized: (1) model a waste heat driven chiller for use on a Navy surface combatant; (2) develop a theory for thermoacoustic devices that do not use a stack; (3) perform experiments on a no-stack device; (4) experimentally map out the heat transfer and drag performance of various heat exchanger types in the presence of oscillating flow; (5) construct a compact thermoacoustic- Stirling engine for use in electrical power generation; (6) investigate Rayleigh streaming; (7) study the time-averaged pressure change across an abrupt change in resonator cross section.
DTIC
Cooling Systems; Heat Exchangers; Stirling Engines

20030109059 Massachusetts Inst. of Tech., Cambridge, MA
Thermal Hydraulic Performance Analysis of a Small Integral Pressurized Water Reactor Core
Sep. 2003; 256 pp.; In English
Report No.(s): AD-A417648; No Copyright; Avail: CASI; A12, Hardcopy

A thermal hydraulic analysis of the International Reactor Innovative and Secure (IRIS) core has been performed. Thermal margins for steady state and a selection of Loss Of Flow Accidents have been assessed using three methodologies to account for uncertainty. The thermal hydraulic analysis has shown that the IRIS is designed with adequate thermal margin for steady state operation, the locked rotor/shaft shear accident (LR/SS) and for variants of the partial loss of flow accident. To treat uncertainties, three methods were used, ranging from conservative, deterministic methods, to more realistic and computationally demanding Monte Carlo-based methods. To facilitate the computational requirements of the thermal hydraulic analysis, a script- based interface was created for VIPRE. This scripted interface (written in Matlab) supplants the existing file-based interface. This interface allows for repeated, automatic execution of the VIPRE code on a script-modifiable input data, and parses and stores output data to disk. This endows the analyst with much greater power to use VIPRE in parametric studies, or using the Monte Carlo- based uncertainty analysis methodology. The Matlab environment also provides powerful visualization capability that greatly eases the task of data analysis.
DTIC
Pressurized Water Reactors; Reactor Cores; Reliability Analysis; Thermal Analysis

20030109062 Michigan State Univ., East Lansing, MI
A Doppler Sensor Array for High-Resolution Measurements of the Wavenumber-Frequency Spectrum of the Turbulent Wall Pressure at High Reynold Numbers
Naguib, Ahmed M.; Oct. 6, 2003; 46 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0858
Report No.(s): AD-A417457; No Copyright; Avail: CASI; A03, Hardcopy

The Doppler frequency shift is utilized as the basic sensing mechanism for a new unsteady-surface pressure measurement technique. The frequency shift is experienced by a focused laser beam reflected off the aluminized top of a flexible-polymer diaphragm subjected to the unsteady pressure. Prototypical sensors based on this concept, with different sizes and diaphragm material and thickness are constructed as well as evaluated. The results provide understanding of the limits of the sensor's sensitivity, bandwidth, resolution and noise-level. Moreover, analysis of typical wall-pressure spectra beneath high- and low-Reynolds-number, boundary layers in light of these limits underlines the potential advantage of the new sensor in resolving the signature of small-scale turbulent structures at high Reynolds numbers.
DTIC
Turbulent Boundary Layer; Reynolds Number

20030109075 Brown Univ., Providence, RI

Control of Mixing in Aeroengines Using Modern Dynamical Systems Methods

Hesthaven, Jan; Haller, George; Mar. 31, 2003; 5 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0133

Report No.(s): AD-A417409; AFRL-SR-AR-TR-03-0225; No Copyright; Avail: CASI; A01, Hardcopy

In this project we have sought to understand and locate coherent material structures that govern turbulent fluid mixing. As we have showed, these structures coincide with invariant manifolds of the fluid particle dynamics. We have developed several numerically assisted analytic criteria to extract invariant manifolds from simulated and measured flow data. Our criteria have been applied by others in analyzing controlled shear flows I, vortex merger problems 2, geophysical data 3, and geological phenomena 4. As an example, Fig. 1 shows coherent structures rendered by our criteria in a two-dimensional turbulence simulation.. Unexpectedly, we have also managed to extend Prandtl's classic steady flow separation criterion to unsteady flows. Remarkably, we also obtained explicit asymptotic formulae for unsteady separation profiles near a general no-slip boundary. As an example, Figure 2. compares a separation prediction from the widely used 'zero-skin friction principle' (Fig. 2a), and from our unsteady separation criterion (Fig. 2b). Figure 3. (a) Instantaneous streamlines, separation points predicted the classical theory (zero skin friction), and actual unsteady flow separation. Separation is visualized by plotting the current position of an initially horizontal layer of fluid particles in the oscillating separation bubble model of S. Ghosh (UTRC). (b)Same as (a), with our analytically predicted unsteady separation profile superimposed. In a new approach to flow control, we have explored the use invariant manifolds to shape global coherent structures via local feedback control. We have applied these ideas in the control of advective mixing behind the flameholder of a combustor and the control of unsteady separation in bluff body shear flows (see Fig. 3).

DTIC

Fluid Dynamics; Engines

20030109095 Naval Research Lab., Washington, DC

Simulation of Flow and Dispersion Around a Surface- Mounted Cube

Cheatham, Sally A.; Boris, Jay P.; Cybyk, Bohdan Z.; Aug. 29, 2003; 26 pp.; In English

Contract(s)/Grant(s): Proj-64-1528-03

Report No.(s): AD-A417469; NRL/MR/6410--03-8705; No Copyright; Avail: CASI; A03, Hardcopy

The time-accurate computational model FAST3D is used to investigate flow over a cube mounted on a flat surface. The effect of resolution, boundary conditions, and the form of the inflow velocity profile on flow evolution and passive tracer dispersion in the vicinity of the cube is considered. Computational results are compared with wind tunnel and water tank data published by a number of authors. It is found that the flow computed around a surface-mounted cube is sensitive to both the form of the upstream velocity profile as well as to conditions at the baseplate surface. Furthermore, time- dependent effects appear to be crucial to the accumulation of accurate flow field statistics and thus a correct understanding of the flow and dispersion patterns.

DTIC

Flow Distribution; Water; Boundary Conditions

20030109116 Naval Postgraduate School, Monterey, CA

Unsteady Pressure Measurements on the Case Wall of a Transonic Compressor

Rodgers, Matt W.; Jun. 2003; 115 pp.; In English; Original contains color illustrations

Report No.(s): AD-A417562; No Copyright; Avail: CASI; A06, Hardcopy

The method of taking unsteady pressure measurements, on a research transonic compressor rig, was lost during the transition from the traditionally designed Vavra stage to the Sanger stage. The Sanger stage was designed using computational fluid dynamics (CFD) techniques. It required a new case wall in which the unsteady pressure sensors, due to outdated software and data acquisition system, were not initially installed. In the present study, unsteady pressure measurements were reestablished, with the installation of sensors and development of a new data acquisition and data reduction system. Data were taken at 60%, 70%, and 80% design speed. Data at 60% and 70% were compared to computational predictions and reasonable agreement was obtained.

DTIC

Transonic Compressors; Pressure Measurement; Walls; Axial Flow

20030109314 Massachusetts Inst. of Tech., Cambridge, MA

Development of a Mesoscale Solid-State Servo- Hydraulic Actuator

Hagood, Nesbitt W., IV; Steyn, J. L.; Feb. 28, 2001; 1088 pp.; In English

Contract(s)/Grant(s): N00014-97-1-0880

Report No.(s): AD-A417615; No Copyright; Avail: CASI; A99, Hardcopy

This report is a compilation of work related to the development of a high-pressure high flow rate piezoelectric micropump. Such a pump would be at the heart of a small servohydraulic actuation system. The objective of this project was to determine the feasibility of such an actuation system. One of the biggest challenges facing small-scale servohydraulic systems is the development of a high performance micro pumping device. To achieve the final result: a) detailed mathematical models of the micropump as well as the micro - servohydraulic system were constructed; b) a micropump was designed, taking into account all the relevant limitations related to the current state-of-the-art microfabrication techniques; and c) a micropump was built and tested. The final micropump was a seven-layer microfabricated device consisting of 4 silicon and 3 glass layers. The silicon layers were fabricated using Deep Reactive Ion Etching (DRIE). The glass layers were made using conventional diamond drilling. The final device was assembled using a sequence of Silicon- silicon fusion bonds and silicon-glass anodic bonds. The maximum performance attained from this device was - a maximum flow rate of 2700 microliters/min and a maximum differential pressure of 450kPa at a piston drive frequency of 12.5kHz.

DTIC

Electrochemistry; Actuators; Electrokinetics; Etching; Resonance; Microfluidic Devices

20030109348 Innovative Scientific Solutions, Inc., Dayton, OH, USA

Advanced Laser Diagnostics of Compressible Flows

Hsu, Kuang-Yu; Mathur, Tarun; Feb. 2003; 38 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-97-C-2702; Proj-2308

Report No.(s): AD-A417724; 2702-FINAL; AFRL-PR-WP-TRM-2003-2075; No Copyright; Avail: CASI; A03, Hardcopy

Advanced laser diagnostics have been developed to study the fundamentals of supersonic flows for scramjet applications. Filtered Rayleigh scattering and planar laser- induced fluorescence (PLIF) techniques were developed and applied for measuring temperature and species in reacting and nonreacting flows. Fundamental studies of a cavity flame- holder in reacting and nonreacting supersonic flows were conducted. Several cavity-configuration and fueling schemes were employed, and combustion performance was documented. Raman scattering was utilized to measure the time-averaged equivalence ratio of cavity fueling. OH-PLIF was used to mark the reaction zone of the combustion and aid the optimization of fueling. An isolator of rectangular cross section with adjustable divergence angles has been evaluated for different inlet Mach numbers. Shock structures and fluctuations of shock position were also identified at various Mach numbers, divergence angles, and pressure ratios. The potential application of a plasma torch as an alternative ignition source for the scramjet combustor was also investigated through experimental and CFD studies. Maintenance and upgrade of the test facility and support of testing were performed.

DTIC

Laser Applications; Compressible Flow; Fluid Mechanics

35
INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

20030108464 Air Force Research Lab., Edwards AFB, CA

Determining Stress Sensor Requirements for a Health Monitoring System Using Finite Elements

Miller, Timothy C.; Aug. 29, 2003; 24 pp.; In English

Report No.(s): AD-A417203; AFRL-PR-ED-VG-2003-217; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available

Detectors; Health

20030108540 Naval Research Lab., Washington, DC

Phase 1: Laboratory Investigation of Portable Instruments for Submarine Air Monitoring

Evans, Thomas W.; Werner, Juliane; Rose-Pehrsson, Susan L.; Hammond, Mark H.; Callahan, John; Sep. 29, 2003; 42 pp.; In English

Report No.(s): AD-A417349; NRL/MR/6110--03-8704; No Copyright; Avail: CASI; A03, Hardcopy

The submarine atmosphere is a unique controlled and monitored environment in which sailors live and work for extended periods of time. Atmosphere monitoring is principally done with the Central Atmosphere Monitoring System, which is used to monitor life gases, permanent gases, and some trace constituents. However, 17 different detectors, primarily colorimetric (Drager) tubes, are currently used to supplement the atmosphere analysis measurements made aboard U.S. Navy submarines. The submarine fleet has requested that these tubes be replaced with a more modern, less labor intensive measurement system. It is possible to replace many of the existing detectors with instruments that will incorporate more than one sensor at a time. This report presents an evaluation of six instruments equipped with oxygen, carbon monoxide, hydrogen sulfide, and lower explosive limit sensors for use in submarines as portable air monitors. This is the first phase of a three-phase program concerned with investigating potential detection methods to replace the Drager tubes currently used. In this phase, the Draeger Multiwarn II and Enmet Omni are both strong candidates and demonstrated good performance. The cross sensitivity of the carbon monoxide sensor with hydrogen is a concern when monitoring the air in submarines and will need further consideration.

DTIC

Air Quality; Carbon Monoxide

20030108715 Texas A&M Univ., College Station, TX, USA

HT Sensor Development

Thomas, Erwin; Kenny, Andrew; Palazzolo, Alan; Smart, Structural Components and Simulation Tools for Increased Engine Efficiency, Flight Range, and Safety; April 2003, pp. 71-78; In English; See also 20030108713; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

HT displacement sensor drive circuit under development. High degree of linearity has been achieved using Bently probe and TAMU circuit. 3D FE magnetic field modelling employed to aid in design of HT probe.

Derived from text

Magnetic Bearings; Sensors

20030109347 California Univ., Riverside, CA, USA

Learning Integrated Recognition for Image Exploitation

Bhanu, Bir; Sep. 30, 2003; 11 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0315

Report No.(s): AD-A417712; AFRL-SR-AR-TR-03-0420; No Copyright; Avail: CASI; A03, Hardcopy

The overall goals of the proposed learning integrated object recognition for image exploitation research effort at the Center for Research in Intelligent Systems of the University of California, Riverside are to improve the performance and reliability of automated systems that can recognize objects in reconnaissance imagery acquired under dynamically changing conditions and for systems that can efficiently extract information from enormous image databases. This requires innovative techniques developed through fundamental scientific research in the fields of machine learning and computer vision. The research accomplished in this effort involves four specific areas: (1) Predicting the performance for recognition systems; (2) Automating methods to develop composite class models for SAR recognition; (3) Learning integrated physics-based fusion of IR and video for target detection; and (4) Learning concepts in images/ videos. This report summarizes the achievements in each of the four major research areas.

DTIC

Mathematical Models; Target Recognition; Data Bases

36
LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

20030108387 New Mexico Univ., Albuquerque, NM
Spatially Resolved Sub-Doppler Overtone Gain Measurements in a Small Scale Supersonic HF Laser
Wisniewski, Charles F.; Dec. 2003; 279 pp.; In English
Report No.(s): AD-A417351; CI02-1285; No Copyright; Avail: CASI; A13, Hardcopy

The overtone gain of a small-scale HF laser was measured using a sub-Doppler tunable diode laser system. Two-dimensional spatially resolved small signal gain and temperature maps were generated, which show a highly inhomogeneous gain medium indicating the dominant role that mixing of the fuel and oxidizer streams has in HF laser performance. The measured gain and temperature data were analyzed with the aid of a two-dimensional computational fluid dynamics code. To reduce uncertainty of important modeling input parameters, novel measurements of reactant concentration, flow velocity and gain length were made. Results show that reactant mixing mechanisms such as turbulence and large-scale vortex structures have a large effect on the gain averaged over a vertical profile while kinetic rate mechanisms such as reaction rate constants and reactant concentration have a greater effect on the maximum system gain. Overtone gain data measured while operating the laser saturated on the fundamental transitions are compared with fundamental lasing output spectra. In all cases, the data are consistent with an equilibrium rotational distribution.
DTIC
Hf Lasers; Laser Outputs; Reaction Kinetics; Supersonic Flow

20030108415 Army Research Lab., Aberdeen Proving Ground, MD, USA
Laser-Based Instrumentation for Real-Time, In-Situ Measurements of Combustible Gases, Combustion By-Products, and Suppression Concentrations During Fire Suppression
McNesby, Kevin L.; Skaggs, R. R.; Miziolek, Andrzej W.; Jul. 2003; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-622618H8000
Report No.(s): AD-A417244; ARL-TR-3004; No Copyright; Avail: CASI; A03, Hardcopy

This report describes results of a 3-year program to investigate applications of laser-based instrumentation to real-time measurements of combustible gases, combustion by- products, and suppression concentrations during suppression of fires and explosions. This program was sponsored by the Department of Defense Strategic Environmental Research and Development Program.
DTIC
Laser Spectroscopy; Real Time Operation; Combustion Products; Fire Control; Gas Analysis; In Situ Measurement

20030108445 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
Controlled-Stress Large-Area Pulsed Laser Deposition of Yttria Stabilized Zirconia
Rounsavall, Paul C.; Aug. 2003; 258 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417097; AFIT/DS/ENG/03-06; No Copyright; Avail: CASI; A12, Hardcopy

The US Air Force has need of parabolic-shaped membrane mirrors for surveillance satellites. The current polymer membrane technology has been unable to overcome shape deformation problems caused by intrinsic stresses from the membrane casting and mounting processes. One proposed solution was to coat the membrane mirrors with a stressed coating to compensate for shape deformations. Thus, the research presented in this dissertation produced controlled-stress large-area pulsed laser deposition (PLD) grown thin films on polymer substrates and investigated optical time-of-flight (TOF) sensor systems and Raman spectroscopy for control for the PLD process with respect to thin film stress. Initially, the PLD-grown film stress was controlled using a constant combination of deposition parameters. Also, the velocity was extracted from the optical TOF data and indicated film stress. As such, the velocity was used to control the laser fluence in order to compensate for slight variations in deposition conditions, which improved the film stress run-to-run stability. Additionally, iterative and theoretical experiments produced large-area YSZ films with less than ten percent total thickness variations. Combining the controlled-stress and large-area aspects produced desirable compensations in shape to the polymer substrates. Finally, Raman spectroscopy was shown to be compatible with the PLD.
DTIC
Pulsed Lasers; Residual Stress; Optical Measuring Instruments; Pulsed Laser Deposition; Yttria-Stabilized Zirconia

20030108689 Aerospace Corp., El Segundo, CA

Modeling HF Gain Generator F-Atom Flows

Kwok, Munson A.; Amimoto, Sherwin T.; May 10, 2003; 31 pp.; In English

Contract(s)/Grant(s): F04701-00-C-0009

Report No.(s): AD-A417365; TR-2000(1019)-1; SMC-TR-03-23; No Copyright; Avail: CASI; A03, Hardcopy

Control volume analysis and one-dimensional reacting gasdynamics have been combined with a unique thermal-mechanical model of a combustor vessel to estimate production of fluorine atoms at the nozzle exit plane. Upon reaction with hydrogen, H2, these F-atoms are a key species in the efficient production of internally energetic hydrogen fluoride (HF) molecules, which is the lasant material for an HF chemical laser. Thus, a quantitative estimate of F-Atom density and more specifically the degree of fluorine (F2) dissociation, alpha, is an essential parameter for the accurate prediction of laser performance. This parameter, as a function of time, has been difficult to experimentally measure or to analyze in such lasers. The method has been applied to the only cylindrical HF chemical laser in operation. Test conditions for the must recent tests of the Alpha Laser are analyzed. It is found for the baseline operating point that alpha reaches a plateau exceeding 0.9 after a sufficiently long operating time. Necessarily for the expediency of rapid calculations, such a model lacks the temporal and spatial fine details of the heat transfer processes, gasdynamics, and boundaries. Therefore, such a model is valuable for insight, but must be used with care for detailed design.

DTIC

Atoms; Fluorine; Hf Lasers

20030109074

Laser Range Safety Tool (LRST) BRDF Reference

Crockett, Gregg; Sep. 2003; 77 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F04701-98-D-0100

Report No.(s): AD-A417649; AFRL-HE-BR-TR-2003-0119; No Copyright; Avail: CASI; A05, Hardcopy

LRST is a software tool for calculating reflected energy hazards in the context of test range development of the Airborne Laser (ABL) system. The LRST software package consists of a suite of programs that provide facilities for describing and simulating test scenarios, including the range, the ABL aircraft laser complement, the target, and the observers. This manual provides a detailed description of the physical basis for the reflection models (BRDFs) implemented in LRST and methods for extracting Maxwell-Beard BRDFs from laboratory measurements.

DTIC

Applications Programs (Computers); Bidirectional Reflectance; Range Safety

20030109077

Laser Range Safety Tool (LRST) Physics Reference

Crockett, Gregg; Sep. 2003; 132 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F04701-98-D-0100

Report No.(s): AD-A417650; AFRL-HE-BR-TR-2003-0120; No Copyright; Avail: CASI; A07, Hardcopy

LRST is a software tool for calculating reflected energy hazards in the context of test range development of the Airborne Laser (ABL) system. The LRST software package consists of a suite of programs that provide facilities for describing and simulating test scenarios, including the range, the ABL aircraft laser complement, the target, and the observers. This manual provides a detailed description of the physical basis of the simulation and the computational algorithms utilized to calculate the radiometry and hazards.

DTIC

Airborne Lasers; Applications Programs (Computers); Range Safety

20030109125 Physical Sciences, Inc., Andover, MA

Dynamics of HF(v,J) Chemiluminescence and Lasing by Infrared Hyperspectral Imaging

Davis, S. J.; Rawlins, W. T.; Oakes, D. B.; Dadusc, G.; Hammer, D. X.; Jun. 2003; 10 pp.; In English

Contract(s)/Grant(s): F29601-02-C-0111; F29601-01-C-0091; Proj-6001

Report No.(s): AD-A417573; No Copyright; Avail: CASI; A02, Hardcopy

This paper presents results from a continuing investigation of mixing flow fields and optical gain profiles in HF chemical laser systems by infrared hyperspectral imaging. Chemiluminescent F + H2 reacting flowfields and chemical laser output beams are imaged at a series of wavelengths, 2.6 to 2.9 microns, by a low-order, spectrally scanning Fabry- Perot

interferometer mated to an infrared camera. The resulting hyperspectral data cubes define the spectral and spatial distributions of the emission. High-resolution images can be processed to determine spatial distributions of the excited state concentrations of the product HF(v,J), as well as spatial distributions of gain on specific laser transitions. This paper describes the instrumentation and its application to detailed observations of reactant mixing and energy transfer in the product HF(v,J), using a low-pressure laboratory reactor developed at Physical Sciences, Inc. (PSI). The measurements confirm that the PSI reactor generates inverted populations of HF(v,J).
DTIC
Chemiluminescence; Hf Lasers; Infrared Spectroscopy

20030109334 Air Force Research Lab., Edwards AFB, CA, USA
Laser Propulsion and the Constant Momentum Mission
Larson, C. W.; Mead, Franklin B., Jr.; Knecht, Sean D.; Jan. 2003; 13 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A417658; AFRL-PR-ED-TP-2003-230; No Copyright; Avail: CASI; A03, Hardcopy

We show that perfect propulsion requires a constant momentum mission, as a consequence of Newton's second law. Perfect propulsion occurs when the velocity of the propelled mass in the inertial frame of reference matches the velocity of the propellant jet. in the rocket frame of reference. We compare constant momentum to constant specific impulse propulsion, which, for a given specification of the mission delta V' has an optimum specific impulse that maximizes the propelled mass per unit jet kinetic energy investment We also describe findings of more than 50 % efficiency for conversion of laser energy into jet kinetic energy by ablation of solids.
DTIC
Lasers; Laser Propulsion

20030109354 West Virginia Univ., Morgantown, WV
EPR and Optical Characterization of Photorefractive Materials Used in Agile Laser Protection
Halliburton, Larry E.; Sep. 24, 2003; 17 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0140
Report No.(s): AD-A417758; AFRL-SR-AR-TR-03-0401; No Copyright; Avail: CASI; A03, Hardcopy

This is the final technical report for a project to study point defects in photorefractive crystals used in optical limiting applications. The specific materials investigated were LiNbO3 and LiTaO3. The experimental techniques used to characterize these crystals were optical absorption, thermoluminescence, and electron paramagnetic resonance (EPR). We obtained congruent and Mg-doped stoichiometric LiNbO3 crystals from Deltronic and vapor- transport-equilibrated LiTaO3 crystals from Stanford University. The stoichiometric LiNbO3 crystal exhibited a large thermoluminescence peak near 94 K. There was no emission from similar congruent crystals. The thermoluminescence from the stoichiometric crystal could be excited with x-rays or 355- nm pulses from a tripled Nd:YAO laser. It is also shown that congruent LiTaO3 crystals do not give thermoluminescence. However, LiTaO3 crystals made stoichiometric by vapor-phase- equilibration (VTE) treatments have a large thermoluminescence peaks near 94 and 98 K. Self-trapped electrons are participating in the recombination process in both materials. The Fe3+ ions in the VTE-treated LiTaO3 have sharp EPR lines, and a complete angular dependence set of data were collected and analyzed to obtain the g matrix and the second and fourth order crystal-field parameters.
DTIC
Point Defects; Photorefractivity; Electron Paramagnetic Resonance; Thermoluminescence

37
MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20030108474 Army Construction Engineering Research Lab., Champaign, IL, USA
Condition Monitoring Technology for Civil Works Lock Operating Machinery
Schimpf, Andrew; Stephenson, L. D.; Kumar, Ashok; Aug. 2003; 69 pp.; In English
Report No.(s): AD-A417254; ERDC/CERL-TR-03-19; No Copyright; Avail: CASI; A04, Hardcopy

This pilot project successfully demonstrated condition monitoring and predictive maintenance at Port Allen Lock by

installation of programmable logic controllers (PLCs) and field sensors for lock operating machinery and structural components at one of the lock's gate leafs. The need to continue such research as a more complete condition monitoring program at Port Allen Lock, and then as a part of an overall computerized control system has also been demonstrated. This study achieved the following goals: (1) It was shown that a PLC control system can be used for high-speed collection of the data from instrumentation transducers used to monitor the condition of lock equipment. It was also shown that the funds used to provide such a condition monitoring system can overlap significantly with those used to upgrade the control system of a lock and dam. Thus, one project can actually help justify the other instead of competing for the same funds. (2) This project showed the accuracy and real-time qualities of the data collected by the PLC system. (3) The data collected can be used onsite for short-term purposes such as static warnings as well as being stored and trended for long-term prediction of maintenance based on the changes to operating machinery conditions. (4) The data can be exported in spreadsheet database form for use with other programs such as Microsoft Excel. SQL Server and OPC data collection platforms are also compatible with this type of data acquisition making it flexible enough to use for virtually any application. The project demonstrated on a small scale that the possibility of future cost savings might be attainable from such instrumentation if applied on a global scale.
DTIC
Dams; Waterways; Numerical Control; Monitors; Data Collection Platforms; Predictions; Locking

20030108714 Texas A&M Univ., College Station, TX, USA
Design High Temperature Thrust Magnetic Bearing (TMB) Test Rig
Palazzolo, A. B.; Mohiuddin, Waqar; Tucker, Randall; Smart Structural Components and Simulation Tools for Increased Engine Efficiency, Flight Range, and Safety; April 2003, pp. 38-61; In English; See also 20030108713; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Design objectives for the test rig include:operation at 30,000 RPM, 1000 degrees F, and 100 lb axial load. System design requirements are discussed.
CASI
Systems Engineering; Thrust Bearings; Test Equipment

20030108717 Texas A&M Univ., Corpus Christi, TX, USA
Radial High Temperature Magnetic Bearing Coil Progress
Preuss, Jason; Hunt, Andrew; Tucker, Randy; Palazzolo, Alan; Smart Structural Components and Simulation Tools for Increased Engine Efficiency, Flight Range, and Safety; April 2003, pp. 62-69; In English; See also 20030108713; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Results are presented for the winding and potting of high temperature radial magnetic bearing c-cores. A failed c-core was replaced and two back-ups were fabricated.Information is also described on a temperature probe for the direct measurement of coil temperature and a high temperature electrical connector.
CASI
Magnetic Bearings; Temperature Probes

20030108721 Texas A&M Univ., College Station, TX, USA
High Temperature Electromagnetic Axial Thrust Bearing
Mohiuddin, Waqar; Palazzolo, Alan B.; Smart Structural Components and Simulation Tools for Increased Engine Efficiency, Flight Range, and Safety; April 2003, pp. 1-37; In English; See also 20030108713; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Drawings and graphs are presented on teh following: Thrust rotor,thrust stator, forged hyperco 27 disk,suggested materials for thrust runner, DC magnetization curve for hyperco 27, tensile strength for forged hyperco 27, block diagram of AISI 4340 test set-up, flux probe inserted into the gap of the AISI 4340 ring, set-up for test of magnetic properties of AISI 4340, induced flux and voltage with applied current, saturated flux density with applied current of 3.25 A, electromagnetic FEA simulation of thrust bearing, eddy currents generated by rotating thrust runner, specification of catcher bearing, Campbell diagram, von Mises stress in the stator, deflection of catcher bearing web, rotor containment vessel calculation,von Mises stress and displacement,stress developed with crowned interface of 0.0018 in. and 0.002 in. radial interference, stress developed in deeply crowned rotor,and stress developed in rotor with NO interference fit.
CASI
Stators; Thrust Bearings

20030108722 Texas A&M Univ., College Station, TX, USA
Two-Dimensional Isolated Ball Bearing Code
Sun, Guangyoung; Palazzolo, Alan B.; Smart, Structural Components and Simulation Tools for Increased Engine Efficiency, Flight Range, and Safety; April 2003, pp. 79-96; In English; See also 20030108713; No Copyright; Avail: CASI; A03, Hardcopy

Code developed for predicting stiffness and power loss drag torque for isolated bearings.
Derived from text
Ball Bearings; Drag

20030108723 Texas A&M Univ., College Station, TX, USA
Three-Dimensional FE of HT Magnetic Thrust Bearing
Mohiuddin, Waqar; Palazzolo, Alan B.; Smart Structural Components and Simulation Tools for Increased Engine Efficiency, Flight Range, and Safety; April 2003, pp. 1; In English; See also 20030108713; No Copyright; A01, Hardcopy; Abstract Only; Available from CASI only as part of the entire parent document

This task was completed under task A.1 with the following results:design of a hyperbolic profile, thrust magnetic bearing for 1,000 Ib. force, 30,000 rpm and 1,000 of service completed; 2 mil radial press fit required to maintain contact on runner ID at 30,000 rpm; 1,000 This produces Von Mises stress of 56,000 psi (1 10 percent of Hiperco 1,000 OF yield stress). Zero press fit produces 40,000 psi peak stress (80 percent of yield). We recommend light press (line to line) with axial preload and locknut for disc attachment.
Derived from text
Magnetic Bearings; Prestressing

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20030108629 Colorado Univ., Boulder, CO
Factors Affecting Creep in Gold on Silicon Bi- Layer Mems Cantilevered Beams
West, Neil E.; Jan. 2003; 68 pp.; In English
Report No.(s): AD-A417266; No Copyright; Avail: CASI; A04, Hardcopy

This research identifies factors that contribute to creep in bi-layer gold on polysilicon MEMS beams. Beams used in this research were manufactured using the Multi-User MEMS Process (MUMPs). Their thicknesses were 2(micrometer) or 4(micrometers) (O.5(micrometers) gold on either 1.5(micrometers) or 3. 5(micrometers) polysilicon), these beams were all 20(micrometers) wide and ranged in length from 80(micrometers) to 280(micrometers) in increments of 40(micrometers). Numerous thermal cycling tests and isothermal hold experiments were conducted at various temperatures. Initial thermal cycling took place at temperatures ranging from room temperature to 275 degrees C, and time durations ranging from 5 to 400 minutes. Isothermal hold experiments were conducted at temperatures ranging from 30 degrees C to 180 degrees C, all isothermal holds have duration of approximately 200 hours. Data was gathered using a Zygo white light interferometric microscope.
DTIC
Cantilever Beams; Creep Properties; Microelectromechanical Systems

20030108770 Army Engineer Research and Development Center, Vicksburg, MS, USA
Proposed Design Criteria on Thin-Wall Precast Panels for Hydraulic Concrete Structures
Yao, Sam X.; Berner, Dale B.; Miles, William; Fehl, Barry D.; Walker, Mike; Aug. 2003; 211 pp.; In English
Report No.(s): AD-A417479; ERDC/GSL-TR-03-14; No Copyright; Avail: CASI; A10, Hardcopy

This report addresses many of the design issues that designers will face with respect to thin-wall precast concrete panels as the U.S. Army Corps of Engineers continues with its innovative approach to construction of navigation structures using lift-in, float-in, and in-the-wet construction methods. The report focuses on the issues of concrete panel design that relate to the special considerations associated with the innovative methods currently being used by the Corps. This report is intended to supplement guidance criteria currently available in Engineer Manuals and Engineer Technical Letters, as well as the

industry standards such as the American Concrete Institute's building code and the American Association of State Highway and Transportation Officials' Bridge Code. Special consideration is given to the applicability of thin-wall precast panels, the materials used in their construction, and constructibility issues associated with them. Other topics that are addressed include loads to consider during precast operations, considerations with regard to connection of precast items, issues associated with in-fill concrete, and requirements and guidelines regarding construction details. Several chapters of the report are devoted to issues that are directly related to design, such as serviceability requirements, strength requirements, flexural design, shear and torsion design, and fatigue strength design. Finally, information is presented on design with respect to composite construction and loading combinations that should be considered for thin-wall panels.
DTIC
Composite Structures; Hydraulic Equipment; Design Analysis; Concretes

20030109165 Naval Postgraduate School, Monterey, CA
Analytic Expression of the Buckling Loads for Stiffened Plates with Bulb-Flat Flanges
Wilmer III., Archie; Jun. 2003; 121 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417591; No Copyright; Avail: CASI; A06, Hardcopy

The subject of this research is the buckling behavior of a simply supported rectangular plate, with a bulb-flat stiffener attached to one side of the plate The plate structure is subjected to axial compression that increases to the buckling load, The stiffener cross-section has a thin web and a bulb-flat flange that extends to one side of the web, Results of the investigation include planar property formulas% for the asymmetric flange geometry, an analytic expression for the Saint Venant torsional constant of the flange cross- section, and an analytic expression for the buckling load corresponding to a tripping mode of the structure, The torsional constant for the bulb-flat stiffener is 15% - 23% higher than understood previously, The analytic expression for the buckling load of the bulb-flat stiffened plates considered in this investigation yields values that are 2% - 6% higher than finite element results, It is also shown that the buckling load of a plate with a bulb-flat stiffener is 3% - 4% less than that of a plate with a T-flange stiffener with the same cross-sectional area, At the onset of stiffener tripping, the torsionally superior bulb-flat tends to bend laterally, while the flexurally superior T-flange tends to twist.
DTIC
Buckling; Loads (Forces); Rigid Structures; Rectangular Plates

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20030108384 Marine Biological Lab., Woods Hole, MA
Combating Uncertainty With Fusion
Jennings, Diana E.; Pavel, Misha; Sep. 8, 2003; 35 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0461
Report No.(s): AD-A417328; No Copyright; Avail: CASI; A03, Hardcopy

This report is a summary of a NASA/ONR-sponsored workshop, Combating Uncertainty with Fusion, that was organized in Woods Hole in April 2002. The main purpose of the workshop was to address a class of difficult computational problems that are characterized by combining large amounts of data or datasets from diverse sources that are related in complex, stochastic, and poorly understood ways. The intent was to determine whether understanding of biological fusion processes could provide guidance to the development of robust algorithms that would alleviate the difficulties encountered in a variety of application areas including the Earth Observation System.
DTIC
Earth Observations (From Space); Multisensor Fusion; Earth Sciences

20030108679 Massachusetts Univ., Amherst, MA
Kinematic and Dynamic Studies of the Coso Geothermal and Surrounding Areas
Lewis, Jonathan C.; Pluhar, Christopher J.; Sep. 12, 2003; 99 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N68936-01-C-0094
Report No.(s): AD-A417358; TR-5-28108; No Copyright; Avail: CASI; A05, Hardcopy

During the final stages of this project we encountered some delays in securing a no-cost extension that was requested in order to complete additional analyses that were not originally anticipated. These analyses include one additional radiometric age and geochemical analyses of lava flow units. This Final Technical Report serves to convey the results of the efforts of Tasks 1,2, 3 and 4 (Table 1.1). Because Task 4 represents Integration and Interpretation, the results contained herein largely reflect efforts under this task. It is expected that two manuscripts for publication will stem directly from the efforts of this project. An additional 4 manuscripts for publication are expected to result from efforts that set the stage for the work conducted under this contract.
DTIC
Kinematics; Dynamics; Geothermal Resources

20030109112 Naval Postgraduate School, Monterey, CA
Texture Analysis of High Resolution Panchromatic Imagery for Terrain Classification
Humphrey, Matthew D.; Jun. 2003; 155 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417506; No Copyright; Avail: CASI; A08, Hardcopy

Terrain classification is studied here using the tool of texture analysis of high-spatial resolution panchromatic imagery. This study analyzes the impact and effectiveness of texture analysis on terrain classification within the Elkhorn Slough Estuary and surrounding farmlands within the central California coastal region. Ikonos panchromatic (1 meter) and multispectral (4 meter) imagery data are examined to determine the impact of adding texture analysis to the standard MSI classification approaches. Spectral Angle Mapper and Maximum Likelihood classifiers are used. Overall accuracy rates increased with the addition of the texture processing. The classification accuracy rate rose from 81.0% for the MSI data to 83.9 percent when the additional texture measures were added. Modest accuracy (55 percent) was obtained from texture analysis alone. The addition of textural data also enhanced the classifier's ability to discriminate between several different woodland classes contained within the image.
DTIC
Spatial Resolution; Terrain Analysis; Mapping; Imagery; High Resolution

44
ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*; and *28 Propellants and Fuels*.

20030108383 Aerospace Corp., El Segundo, CA
Investigating the High-Rate Discharge Capability of 18650-Type Li-Ion Cells
Eftekharzadeh, S.; Wasz, M. L.; Jun. 15, 2003; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04701-00-C-0009
Report No.(s): AD-A417298; TR-2003(8555)-2; SMC-TR-03-24; No Copyright; Avail: CASI; A03, Hardcopy

The high-rate discharge capability of 18650-type lithium-ion cells has been investigated using two commercial cells from Canon battery (A&TB Cells) and Sony, and one space- grade lithium-ion cell. All cells exhibit good voltage stability at various states of charge during pulse application, with Canon (A&TB) cells having the largest drop in voltage. These Canon (A&TB) cells also show the greatest sensitivity to aging with respect to pulse performance, exhibiting irregular voltage signature due to aging. The voltage drop during the pulse load is found to be independent of the pulse rate for all the cells. The voltage drop for the space-grade lithium- ion cell is also independent of the state of charge, exhibiting similar loss at different voltages. The two commercial cells exhibit a higher loss of voltage due to pulse load at lower states of charge. This data indicates that voltage loss at high rates needs to be tested at the lowest state of charge for an intended application. This finding is in contrast with silver-zinc cells, which typically do not have a strong dependence on states of charge.
DTIC
Lithium; Battery Chargers; Electrochemical Cells; Discharge

45
ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20030108781 Army Cold Regions Research and Engineering Lab., Hanover, NH, USA
Estimates for Explosives Residue from the Detonation of Army Munitions
Hewitt, Alan D.; Jenkins, Thomas F.; Ranney, Thomas A.; Stark, Jeffrey A.; Walsh, Marianne E.; Sep. 2003; 96 pp.; In English
Report No.(s): AD-A417513; ERDC/CRREL-TR-03-16; No Copyright; Avail: CASI; A05, Hardcopy

Snow was used as a collection medium to examine explosives residues following the high-order detonation of various military munitions. After detonation, a set of large (1-sq m) samples of residue-covered snow were collected, processed and analyzed for explosives without cross contamination from previous detonations and other potential matrix interferences. Trials were performed to quantity explosives residues following the detonation of 60-, 81-, and 120-mm mortar rounds, 105- and 155-mm howitzer rounds M67 hand grenades. 40-mm rifle grenades, blocks of C4, several different types of land mines, bangalore torpedoes, and a shaped demolition charge. Munitions were detonated following both common military live-fire and blow-in-place techniques. When possible, the same munition was detonated several times using the same conditions to provide a more reliable estimation of the percentage of high explosives that were deposited on the snow surface. In addition to using the snow surface as a collection medium, aluminum trays and steel plates were used in some of the detonation trials. The blowing in place of TNT-filled munitions often resulted in the deposition of near-percent levels of TNT from the main charge that was estimated to lead to mg/kg concentrations in surface soils. When we observed high concentrations of TNT in residue samples, often 2,4-DNT, 2,6-DNT, TNB, 2-ADNT, and 4-ADNT were also present at much lower concentrations. In contrast, the percentage of high explosives deposited from live-fire detonations of Comp-B-filled howitzer rounds, mortar rounds, and hand grenades was always less than 0.002%, leading to low g/kg or ng/kg surface soil concentrations. Overall residue deposition from live-fire-high-order detonations was much lower than for munitions destroyed using blow-in-place techniques. Detonation residues for other munitions that were evaluated fell between these two ranges.
DTIC
Ammunition; Residues; Estimating; Explosives; Detonation

46
GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20030108379 Pennsylvania State Univ., University Park, PA
Forecasting the Nighttime Evolution of Radio Wave Ducting in Complex Terrain Using the MM5 Numerical Weather Model
Kucas, Matthew E.; Aug. 2003; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00039-97-D-0042
Report No.(s): AD-A417262; No Copyright; Avail: CASI; A03, Hardcopy

This study tests the effectiveness of using mesoscale models to forecast operationally those atmospheric conditions that cause anomalous propagation of radio waves. Providing early warning about where and when such conditions will develop would be particularly useful for military communications. To test mesoscale models' ability to provide such early warning, the Pennsylvania State University / National Center for Atmospheric Research Fifth Generation Mesoscale Model (MM5) simulates atmospheric conditions around the mountainous, desert terrain near Nellis Air Force Base in Nevada for five forecast periods during the summer and fall of 2002. The extent of ducting regions predicted by the model and the mechanisms that result in the development of those regions are examined. The sensitivity of model predictions to changes in horizontal and vertical resolution is also tested. Results of these analyses reveal that rapid radiational cooling around sunset and subsequent cold air pooling establish vertical temperature gradients that, along with pre-existing moisture gradients, are compacted by gravity waves along the lee sides of mountains within the model domain. This gradient compaction drives changes in the electromagnetic refractivity of the atmosphere that can trap radio waves near the Earth's surface. The sensitivity tests show that increasing the model's horizontal resolution increases the area of predicted ducting significantly. Increasing the vertical

resolution does not increase the area of predicted ducting by much, but does sharpen the edges of larger predicted ducting regions.
DTIC
Forecasting; Radio Waves; Atmospheric Models; Wave Propagation

20030108660 Naval Research Lab., Washington, DC
The Effect of Electric Field Structure on Joule Heating
Walker, D. N.; Amatucci, W. E.; Ganguli, G.; May 31, 2000; 18 pp.; In English
Report No.(s): AD-A417287; NRL/MR/6750--00-8449; No Copyright; Avail: CASI; A03, Hardcopy

We have recently performed a detailed characterization of ion Joule heating perpendicular to an axial magnetic field in the laboratory in a simulated ionospheric plasma environment which contains localized electric field structuring. Since Joule heating is often regarded as an important mechanism contributing to energization of outflowing heavy ions observed by higher altitude auroral satellites, this work has particular relevance to space physics issues; and, to our knowledge, has not been investigated systematically in a controlled environment. Since transverse (to B) ionospheric electric fields are rarely uniform but tend to show spatial and temporal structure, often as small as an ion gyroradius, the ability to systematically vary the spatial extent and magnitude of the electric field region and to observe the effect on ion energy is important. The experiment makes use of a concentric set of separately biasable ring anodes which generate a radial electric field with controllable scale length perpendicular to an ambient axial magnetic field. Joule heating results from ion-neutral collisions occurring within this transverse, dc electric field region.
DTIC
Electric Fields; Energy Transfer; Magnetospheres

20030108774 Naval Postgraduate School, Monterey, CA
Mobile Source Development for Seismic-Sonar Based Landmine Detection
MacLean, Douglas J.; Jun. 2003; 72 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417519; No Copyright; Avail: CASI; A04, Hardcopy

Landmines continue to be a threat to both military and civilian communities throughout the world. Current methods of detection, while better than nothing, could certainly be improved. Seismic SONAR is a promising new technology that may help save countless lives. The goal of this thesis was to advance Seismic SONAR development by introducing a mobile source which could be easily used in practical applications. A small tracked vehicle with dual inertial mass shakers mounted on top was used for the mobile source. The source accurately transmitted the shaker signal into the ground, and its mobility made it a practical choice for field operations. It excited Rayleigh waves, as desired, but also generated undesirable P-waves and was not found to be directional. It proved incapable of finding a target. Improvements, such as a deploying an array of mobile sources and a stronger source, should vastly enhance the performance of such tracked vehicles in seismic SONAR mine detection and should be pursued.
DTIC
Mine Detectors; Seismology; Seismic Waves

20030109338 NorthWest Research Associates, Inc., Bellevue, WA
Investigations of the Nature and Behavior of Plasma-Density Disturbances That May Impact GPS and Other Transionospheric Systems
Andreason, Angela M.; Holland, Elizabeth A.; Fremouw, Edward J.; Mazzella, Andrew J., Jr.; Rao, G. S.; Oct. 31, 2002; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-97-C-0078; Proj-1010
Report No.(s): AD-A417708; NWRA-CR-02-R247; AFRL-VS-TR-2003-1540; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes research during a contract for investigating (a) natural variations in ionospheric total electron content (TEC) and (b) plasma and electromagnetic effects produced by transmitting high-powered HF waves into the ionosphere. Ongoing efforts to maintain and utilize data from the Air Force Ionospheric Measuring Systems are being conducted. Initial efforts in upgrading these systems for enhanced data collection and reporting capabilities also are being conducted. Preliminary scintillation capabilities at the GPS L1 and L2 frequencies were established, with additional arrangements for incorporating UHF scintillation measurements also being accomplished. An array of diagnostic instruments is being maintained and enhanced in association with the High- frequency Active Auroral Research Program (HAARP). In addition to a classic riometer and a GPS Total Electron Content (TEC) sensor previously operating at the HAARP site, NWRA

also operates a set of Transit receivers for measurements of TEC and scintillation at VHF and UHF, supplementing the receiver at HAARP with a receiver north of the site and an additional receiver installed south of the HAARP site.
DTIC
Electron Density (Concentration); Global Positioning System; Plasma Density; Ionospheric Disturbances

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20030108398 Federal Aviation Administration, Atlantic City, NJ
Terminal Convective Weather Forecast (TCWF) 2000 Demonstration Report
Sims, Danny; McGettigan, Starr; Fidalgo, Cynthia; Jun. 2003; 104 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417211; DOT/FAA/CT-TN03/6; No Copyright; Avail: CASI; A06, Hardcopy

The Terminal Convective Weather Forecast (TCWF) 2000 Demonstration was conducted during the convective season at Air Traffic Control (ATC) facilities in Memphis, TN. The demonstration was conducted by ACB-630 to ascertain the TCWF overall utility, ease of use, readability, and perceived benefit to ATC tasking. TCWF was developed at the Massachusetts Institute of Technology Lincoln Laboratory (MIT/LL) under FAA Aviation Weather Research Program funding. The product provides a graphical 0 to 60-minute forecast of convective weather for an airport terminal area. Results indicated overall positive impressions Users reported the TCWF provided benefit in performing ATC tasks; was a beneficial supplement to the Integrated Terminal Weather System (ITWS); and enhanced situational awareness.
DTIC
Air Traffic Control; Weather Forecasting

20030108462 Boston Coll., Chestnut Hill, MA
Analysis of Multiple Wavelength Lidar Backscatter From Cirrus
Roadcap, John R.; Dao, Phan D.; McNicholl, Patrick J.; Feb. 2003; 87 pp.; In English
Contract(s)/Grant(s): 10100TA1; Proj-1010
Report No.(s): AD-A417201; AFRL-VS-TR-2003-1567; No Copyright; Avail: CASI; A05, Hardcopy

Lidar backscatter from cirrus cloud particles at multiple wavelengths (532 nm, 1064 nm, 10591 nm) was measured at Hanscom AFB, MA in August 2001. Range-resolved measurements were made for several hours daily at altitudes from 9 km to 16 km over a temperature range of -30C to -70C. Three days were selected for study -- 9 August, 14 August, and 16 August 2001. Cirrus backscatter measurements were analyzed in combination with scattering theory for ice spheres and long ice cylinders to better understand their behavior. For 532 nm and 1064 nm, the logarithm (base 10) of backscatter magnitudes (/m-sr) ranged from 4.5 to -6.0 within the cloud area while backscatter magnitudes for 10591 nm ranged from -6.5 to -8.5. Agreement existed between the range of measured backscatter wavelength ratio magnitudes and those computed from scattering theory but no consistent information was discerned concerning modal particle sizes. Calculations of cirrus ice water content, exinction-to- backscatter ratio, and optical depth yielded magnitudes consistent with published values for in-situ and remote measurements.
DTIC
Optical Radar; Backscattering; Cirrus Clouds

20030108643 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evaluation of Transport in the Lower Tropical Stratosphere in a Global Chemistry and Transport Model
Douglass, Anne R.; Schoeberl, Mark R.; Rood, Richard B.; Pawson, Steven; [2002]; 1 pp.; In English; American Geophysical Union Fall Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

A general circulation model (GCM) relies on various physical parameterizations and provides a solution to the atmospheric equations of motion. A data assimilation system (DAS) combines information from observations with a GCM forecast and produces analyzed meteorological fields that represent the observed atmospheric state. An off-line chemistry and transport model (CTM) can use winds and temperatures from a either a GCM or a DAS. The latter application is in common usage for interpretation of observations from various platforms under the assumption that the DAS transport represents the actual atmospheric transport. Here we compare the transport produced by a DAS with that produced by the particular GCM that is combined with observations to produce the analyzed fields. We focus on transport in the tropics and middle latitudes by comparing the age-of-air inferred from observations of SF6 and CO2 with the age-of-air calculated using GCM fields and

DAS fields. We also compare observations of ozone, total reactive nitrogen, and methane with results from the two simulations. These comparisons show that DAS fields produce rapid upward tropical transport and excessive mixing between the tropics and middle latitudes. The unrealistic transport produced by the DAS fields may be due to implicit forcing that is required by the assimilation process when there is bias between the GCM forecast and observations that are combined to produce the analyzed fields. For example, the GCM does not produce a quasi-biennial oscillation (QBO). The QBO is present in the analyzed fields because it is present in the observations, and systematic implicit forcing is required by the DAS. Any systematic bias between observations and the GCM forecast used to produce the DAS analysis is likely to corrupt the transport produced by the analyzed fields. Evaluation of transport in the lower tropical stratosphere in a global chemistry and transport model.

Author

Atmospheric General Circulation Models; Stratosphere; Tropical Regions; Transport Theory; Atmospheric Circulation

20030108644 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Influence of Tropospheric Processes in Modeling the Middle Atmosphere with Gravity Waves

Mayr, H. G.; Mengel, J. G.; Drob, D. P.; Porter, H. S.; [2002]; 1 pp.; In English; American Geophysical Union Fall Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Our Numerical Spectral Model (NSM) extends from the ground up into the thermosphere and has a vertical grid point resolution of about 0.5 km to resolve the interactions of gravity waves (GWs) described with Hines' Doppler Spread Parameterization (DSP). This model produces in the stratosphere and mesosphere the major features of QBO, SAO, tides, and planetary waves. The purpose of this paper is to discuss results from an initial study with our 3D model that shows how certain tropospheric processes can affect the dynamics of the middle atmosphere. Under the influence of tropospheric heating, and augmented by GW interactions, two distinct but related processes can be identified. (1) A meridional circulation develops in the stratosphere, with rising motions at low latitudes that are in magnitude comparable to the downward propagation of the QBO. As Dunkerton pointed out, a larger GW source is then required to reproduce the observed QBO, which tends to move us closer to the values recommended for the DSP. This has significant consequences for our model results that describe the upper mesosphere, considering the general importance of GWs for this region and in influencing planetary waves (e.g., 2-day wave) and tides in particular. (2) Tropospheric heating produces zonal jets near the tropopause that are related to latitudinal variations in pressure and reversing temperature variations (resembling the dynamical conditions near the mesopause), which in turn is conducive to generate baroclinic instability. Modeling results show that our ability to generate the QBO critically depends on the magnitude of the temperature reversal that is a measure of this instability. Planetary waves are generated in this process, which can apparently interfere with or augment the GW interactions. As originally demonstrated by Lindzen and Holton, the eastward propagating Kelvin waves and westward propagating Rossby gravity waves (generated by tropospheric convection) can in principle provide the acceleration to influence the QBO, and we were able to confirm this with our 3D model.

Author

Gravity Waves; Mathematical Models; Middle Atmosphere; Parameterization; Spectral Theory; Troposphere

20030108647 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Science Applications International Corp., Greenbelt, MD, USA

Impact of Flow-Dependent Error Correlations and Tropospheric Chemistry on Assimilated Ozone

Wargan, K.; Stajner, I.; Hayashi, H.; Pawson, S.; Jones, D. B. A.; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly, 6-11 Apr. 2003, Nice, France; No Copyright; Avail: Other Sources; Abstract Only

The presentation compares different versions of a global three-dimensional ozone data assimilation system developed at NASA's Data Assimilation Office. The Solar Backscatter Ultraviolet/2 (SBUV/2) total and partial ozone column retrievals are the sole data assimilated in all of the experiments presented. We study the impact of changing the forecast error covariance model from a version assuming static correlations with a one that captures a short-term Lagrangian evolution of those correlations. This is further combined with a study of the impact of neglecting the tropospheric ozone production, loss and dry deposition rates, which are obtained from the Harvard GEOS-CHEM model. We compare statistical characteristics of the assimilated data and the results of validation against independent observations, obtained from WMO balloon-borne sondes and the Polar Ozone and Aerosol Measurement (POAM) III instrument. Experiments show that allowing forecast error correlations to evolve with the flow results in positive impact on assimilated ozone within the regions where data were not assimilated, particularly at high latitudes in both hemispheres. On the other hand, the main sensitivity to tropospheric chemistry is in the

Tropics and sub-Tropics. The best agreement between the assimilated ozone and the in-situ sonde data is in the experiment using both flow-dependent error covariances and tropospheric chemistry.
Author
Error Analysis; Ozone; Troposphere; Covariance; Mathematical Models; Atmospheric Chemistry

20030108649 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Science Applications International Corp., Greenbelt, MD, USA
Monitoring and Assimilation of MIPAS and SCIAMACHY Ozone Data
Wargan, K.; Winslow, N.; Stajner, I.; Rood, R.; Pawson, S.; [2003]; 1 pp.; In English; EGS-AGU-EUG Joint Assembly, 6-11 Apr. 2003, Nice, France; No Copyright; Avail: Other Sources; Abstract Only

Preliminary results are presented from experiments that integrate ozone observations from two ENVISAT-borne instruments with the ozone data assimilation system developed at NASA's Data Assimilation Office (DAO). The data used are ozone total column provided by the Scanning Imaging Absorption Spectrometer for Atmospheric Chartography (SCIAMACHY) and stratospheric profiles from the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) instrument. The DAO's existing system sequentially assimilates the Solar Backscatter Ultraviolet/2 total and partial ozone column data. Incorporation of SCIAMACHY and MIPAS data is done in two stages. First, the observations are monitored. The monitoring consists of computing the differences between Envisat observations and the ozone system forecast, i.e. observed-minus-forecast (O-F) residuals. The O-F residuals are then analyzed using simple statistical methods to examine the spatial distribution of differences, which are large for SCIAMACHY near the terminator. In the second stage, the MIPAS data will be actively assimilated along with the SBW/2 observations; any preliminary results of note will be discussed.
Author
Satellite-Borne Instruments; Atmospheric Sounding; Imaging Spectrometers; Michelson Interferometers; Mapping; Absorption Spectra; Ozone

20030108651 Science Applications International Corp., Greenbelt, MD, USA
On the Issue of Excess Lower Stratospheric Subtropical Transport in GEOS-DAS
Tan, Wei-Wu; Geller, Marvin; Pawson, Steven; [2002]; 1 pp.; In English; American Geophysical Union Fall Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

In recent years, data assimilation has become an indispensable tool for our understanding of the global features of meteorological variables. However, assessments of transport characteristics using trajectory related methods as well as chemical transport models (CTMs) show that results derived from assimilated (or analyzed) winds exhibit significantly larger mixing and entrainment rates compared to results derived from GCM winds, which are closer to results derived from observations (e.g., Douglass et al., 2002; Schoeberl et al., 2002). This discrepancy presents a serious challenge to our ability to understand and model global trace gas transport and distribution. We use the GEOS-DAS to explore this issue by examining how the process of data assimilation alters the dynamics of the underlying GCM and how this leads to the excess of lower stratospheric mixing and transport in the subtropics. In particular, we show that significant model biases in tropical winds necessitate large analysis increments. These increments directly force large subtropical regions of instability with negative PV gradient on the one hand, and generate excessive noise in the tropical wind fields on the other. The result is an excess of transport in the lower stratospheric subtropics.
Author
Stratosphere; Tropical Regions; Geos Satellites (Esa); Data Processing

20030108661 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Ground-Based Profiling Differential Absorption LIDAR System for Measuring CO2 in the Planetary Boundary Layer
Andrews, Arlyn E.; Burris, John F.; Abshire, James B.; Krainak, Michael A.; Riris, Haris; Sun, Xiao-Li; Collatz, G. James; [2002]; 1 pp.; In English; American Geophysical Union Fall Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Ground-based LIDAR observations can potentially provide continuous profiles of CO2 through the planetary boundary layer and into the free troposphere. We will present initial atmospheric measurements from a prototype system that is based on components developed by the telecommunications industry. Preliminary measurements and instrument performance calculations indicate that an optimized differential absorption LIDAR (DIAL) system will be capable of providing continuous hourly averaged profiles with 250m vertical resolution and better than 1 ppm precision at 1 km. Precision increases (decreases)

at lower (higher) altitudes and is directly proportional to altitude resolution and acquisition time. Thus, precision can be improved if temporal or vertical resolution is sacrificed. Our approach measures absorption by CO2 of pulsed laser light at 1.6 microns backscattered from atmospheric aerosols. Aerosol concentrations in the planetary boundary layer are relatively high and are expected to provide adequate signal returns for the desired resolution. The long-term goal of the project is to develop a rugged, autonomous system using only commercially available components that can be replicated inexpensively for deployment in a monitoring network.
Author
Carbon Dioxide; Differential Absorption Lidar; Planetary Boundary Layer; Ground Based Control; Autonomy

20030108777 Military Academy, West Point, NY
Imagery Enhancement to the Disposable, Air- droppable, Meteorological Tower Array (DAMTA)
Bailey, Jacob; Bunt, Dave; Green, Chris; Lamm, Gregory A.; Buckingham, James M.; Jun. 2003; 141 pp.; In English
Report No.(s): AD-A416541; DSE-TR-03-01; No Copyright; Avail: CASI; A07, Hardcopy

The Army Research Laboratory (ARL), Computational and Information Sciences Directorate, Battlefield Environment Division, at White Sands Missile Range (WSMR), New Mexico is currently involved in overseeing the development of a new battlefield weather information resource. This new resource deemed DAMTA (disposable, Air-droppable, Meteorological Tower Array) will consist of multiple individual towers, which will be dispersed over selected battlefield locations by an airborne platform. They will collect and transmit meteorological data in unattended operation for up to 30 days. The purpose of this current research project is to investigate the benefits of augmenting the DAMTA with digital imagery sensors to collect near real-time images of weather conditions on the battlefield. The mission of this project was to provide a detailed recommendation for imagery enhancement to the DAMTA platform. The specific deliverables were as follows: (1) To determine the benefits that will accrue to the army through the use of imagery enhanced DAMTA; (2) to determine a specific off-the-shelf camera most suited to integration with the DAMTA; (3) to construct a prototype demonstrating the best method of integrating cameras with the DAMTA platform.
DTIC
Meteorological Instruments; Towers; Imagery; Airdrops; Weather

20030109096 Army Research Lab., Adelphi, MD
A Two-Dimensional Meteorological Computer Model for the Forest Canopy
Tunick, Arnold; Aug. 2003; 30 pp.; In English
Contract(s)/Grant(s): Proj-3FEJ
Report No.(s): AD-A417487; ARL-MR-569; No Copyright; Avail: CASI; A03, Hardcopy

This report presents the equation set, modeling assumptions, and some initial results from a new, physics- based computer model that is being developed for two- dimensional forest canopy wind flow, temperature, and turbulence calculations. The model is based on the conservation (simplified Navier-Stokes) equations for continuity, momentum, Reynolds stress, energy, heat flux, and turbulent temperature variance. A set of simultaneous equations for each of 12 computed variables is solved iteratively on a computational grid consisting of 10 x 60 points. Horizontal grid spacing is 50 m, and vertical grid spacing is 0. 5 m. The model domain is 500 x 30 m. It is anticipated that improved turbulence and micrometeorological models for forest canopies will become increasingly useful for military acoustics application research.
DTIC
Computer Programs; Two Dimensional Models; Meteorological Parameters; Forests

20030109101 New Mexico Univ., Albuquerque, NM
The Extratropical Transition of Tropical Cyclones
Ritchie, Elizabeth A.; Sep. 30, 2003; 9 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0937
Report No.(s): AD-A417496; No Copyright; Avail: CASI; A02, Hardcopy

The extratropical transition (ET) of tropical cyclones can sometimes result in rapid changes in the structure and intensity of the tropical cyclone. In particular, the second stage of ET can result in very different results from complete dissipation to rapid intensification into an intense midlatitude cyclone. Whether the tropical cyclone dissipates or reintensifies appears to be strongly dependent on the details of the midlatitude circulation. At the heart of the forecast problem is a lack of knowledge of the fundamental physical changes occurring during ET. Results are presented that show that the details of the midlatitude circulation are probably less important than the basic midlatitude structure for reintensification. Simulations presented here

show that variations in the strength of the midlatitude upper-level trough have little impact on the subsequent reintensification of the tropical cyclone. Rather, it is more likely the energy of the background environmental state, and the phasing between the trough and TC that ultimately determine the intensity to which the cyclone can reintensify.
DTIC
Tropical Storms; Temperate Regions; Cyclones

20030109309 Oregon State Univ., Corvallis, OR
Spatial Variations of the Wave, Stress and Wind Fields in the Shoaling Zone
Mahrt, Larry; Sep. 2, 2003; 88 pp.; In English
Contract(s)/Grant(s): N00014-97-1-0279
Report No.(s): AD-A417728; N0089; No Copyright; Avail: CASI; A05, Hardcopy

Aircraft data collected at approximately 15 m above the sea surface in the coastal zone are analyzed to examine the spatial distribution of surface stress. Advection of stronger turbulence from land dominates the near-surface turbulence for the first few kilometers offshore. With offshore flow of warm air over cold water, strong stratification leads to very small surface stress. Because the stability restricts the momentum transfer to the waves, the aerodynamic surface roughness decreases to very small values, which in turn decreases atmospheric mixing. The redevelopment of the boundary layer farther downstream is examined. Computation of fluxes from observations for stable cases is difficult due to a variety of errors including large random flux errors, possible instrumental loss of small-scale flux, difference between the surface flux and that at the observational level, and inadvertent capture of mesoscale motions in the computed turbulent fluctuations. Although the errors appear to be substantial, the aircraft momentum fluxes compare favorably with those from sonic anemometers on two buoys and a tower at the end of a 570-m pier, even with near collapse of the turbulence.
DTIC
Turbulence; Spatial Distribution

20030109316 Naval Postgraduate School, Monterey, CA
COAMPS Modeled Surface Layer Refractivity in the Roughness and Evaporation Duct Experiment 2001
Newton, D. A.; Jun. 2003; 76 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417619; No Copyright; Avail: CASI; A05, Hardcopy

A study of the performance of the Coupled Ocean- Atmosphere Mesoscale Prediction System (COAMPS) was performed based on collected METOC properties affecting radar propagation during the Roughness and Evaporation Duct (RED) experiment conducted off the windward coast of Oahu, HI. The measured refractivity influencing parameters (SST, air temperature, humidity, and wind speed) were compared to COAMPS predicted values. Using the NPS bulk evaporation duct model, profiles of the modified refractivity were computed from the buoy data and compared to profiles computed from the COAMPS data. The profiles were obtained concurrently with S-Band propagation measurements along a 26-km path. The radar propagation predictions created by APM from the modified refractivity profiles, derived from the measured METOC values and COAMPS modeled values, were compared to the in situ measured propagation losses. The mean RMS error of the prop loss predictions derived from the COAMPS forecasted METOC values was <4 dB compared to a mean RMS error of <3 dB from the in situ measurement derived prop loss predictions. Significantly larger errors occurred at the COAMPS analysis times. Overall, the results are very promising for this trade wind region, where the air is cooler than the relatively warm sea surface.
DTIC
Weather Forecasting; Marine Meteorology; Atmospheric Refraction

51
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20030108382 Washington State Univ., Pullman, WA
Blocking HER-2-Mediated Transformation with a Dominant Form of HER-3
Ram, Tracy G.; Jun. 2003; 33 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0490
Report No.(s): AD-A417299; No Copyright; Avail: CASI; A03, Hardcopy

Amplification of the HER-2 gene often leads to breast cancer by causing cells to make abnormally high levels of the wild-type HER-2 protein. Evidence now shows that the interaction between HER-2 and HER-3 leads to the constitutive activation of HER-2/HER-3 heterodimers in breast cancer cells with HER-2 gene amplification, and HER-2/HER-3 potently activates multiple signal transduction pathways involved in mitogenesis. This indicates that inhibition of the interaction between HER-2 and HER-3 may be an especially effective and unique strategy for blocking the effects of HER-2 in human breast cancer cells. Therefore, we constructed retroviral expression vectors that code for a dominant negative form of HER-3 that can inactivate the function of HER-2/HER-3. Dominant negative HER-3 specifically inhibited proliferation induced by heregulin (the ligand for HER-2/HER-3) as well as the growth factor-independent (i.e. autonomous) proliferation and anchorage-independent growth of breast cancer cells with HER-2 gene amplification. We have used these dominant negative HER-3 vectors in experiments to determine the effectiveness of dominant negative HER-3 for blocking HER-2/HER-3 activation, signaling and growth in culture and in vivo for different breast cancer cell lines with HER-2 gene amplification.
DTIC
Blocking; Cancer; Mammary Glands; Proteins

20030108409 Virginia Commonwealth Univ., Richmond, VA, USA
Characterization of Streptococcus sanguis Mutants Generated by Signature-Tagged Mutagenesis
Noe, Jody C.; Aug. 2003; 86 pp.; In English
Report No.(s): AD-A417228; CI02-1276; No Copyright; Avail: CASI; A05, Hardcopy

Streptococcus sanguis belongs to the viridans group of oral streptococci, which cause 40-50% of human native valve endocarditis. Identification of new vimlence factors is important for drug and vaccine development. A transposon-based random mutagenesis technique called signature-tagged mutagenesis (STM) was used to search for new virulence factors. Four signature-tagged mutants exhibiting decreased virulence in a rabbit model were chosen for characterization. Growth studies suggested that poor growth may have contributed to their decreased virulence. Next, mutant DNA was cloned into Escherichia coli to characterize the sequences flanking the transposon. Lastly, all mutants were characterized using arbitrarily primed polymerase chain reaction. It was determined that plasmid DNA was inserted with the transposon in three of the four mutants. Additionally, in two of the mutants, the transposon was flanked by apparently non- conflguous sequences. These surprising results may be due to unforeseen events occurring during the in vitro transposition stage of STM.
DTIC
Mutagens; Vaccines; Streptococcus; Bacteria; Oral Hygiene; Mutagenesis

20030108411 Kentucky Univ., Lexington, KY, USA
Anxiety is not Manifested by Elevated Heart Rate and Blood Pressure in Acutely Ill Cardiac Patients
DeJong, Marla J.; Sep. 2003; 22 pp.; In English
Report No.(s): AD-A417229; CI02-1268; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this study was to determine whether heart rate and blood pressure were related to level of anxiety at the time of measurement in patients with chronic advanced HF, patients with AMI, and healthy individuals.
DTIC
Blood Pressure; Myocardial Infarction; Heart Rate; Cardiology

20030108442 Wake Forest Univ., Winston-Salem, NC, USA
Mechanism of FADD-DN-Induced Apoptosis in Normal Breast Cells
Thomas, Lance R.; Apr. 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0611
Report No.(s): AD-A417051; No Copyright; Avail: CASI; A03, Hardcopy

Normal cells undergo apoptosis in response to inappropriate growth signals or the lack of overt survival signals. Tumor cells possess defects in apoptosis regulatory pathways and do not undergo apoptosis in these situations. There are two modes of apoptosis - an intrinsic pathway initiated by stress such as DNA damage and an extrinsic pathway resulting from activation of death receptors. Binding of ligand to a death receptor such as Fas, TNFRl or TRAIL receptors 1 and 2 leads to activation of that receptor. This results in the recruitment of a cytoplasmic adaptor protein FADD to the receptor complex and activation of caspase-8. Because FADD is an essential component of receptor mediated apoptosis, a dominant-negative version (FADD-DN) is able to block both Fas and TNF induced apoptosis in many cell lines. However, experiments in our lab indicate that FADD-DN can kill normal human breast epithelial cells but not breast tumor cells. Since the only known role of FADD is an adaptor molecule, this suggests that FADD-DN interacts with one or more proteins expressed in breast epithelia. Because

breast tumor cells do not die in response to FADD-DN, the potential FADD-DN interacting partners are likely to be involved in carcinogenesis.
DTIC
Apoptosis; Cells (Biology); Mammary Glands; Receptors (Physiology)

20030108460 Defence Research Establishment Suffield, Ralston, Alberta, Canada
Characterisation of Potential Antimicrobial Targets for Tuberculosis. 1. Methionine Adenosyltransferase in Mycobacterium Tuberculosis and M. Smegmatis
Berger, Bradley J.; Knodel, Marvin H.; Apr. 2003; 35 pp.; In English
Report No.(s): AD-A417186; DRDC-TR-2003-032; X5-X5; No Copyright; Avail: CASI; A03, Hardcopy

Tuberculosis remains a key concern for the Canadian Forces in its overseas deployments. As drug-resistant forms of the disease continue to spread, there is a need to discover and characterize new drug targets in the organism. The enzyme methionine adenosyltransferase (S-adenosylmethionine synthetase), which catalyzes the formation of S-adenosylmethionine from methionine and ATP, has been cloned, expressed, and characterized in Mycobacterium tuberculosis and its common model organism M. Smegmatis. The two gene sequences were both 1200 base pairs in length. and 87% identical with respect to the primary amino acid sequence.
DTIC
Antiinfectives and Antibacterials; Diseases; Methionine; Tuberculosis; Amino Acids

20030108469 Walter Reed Army Medical Center, Washington, DC
Department of Clinical Investigation (DCI)
Sjogren, Maria H.; Oct. 2002; 813 pp.; In English
Report No.(s): AD-A417205; WRAMC-RCS-MED-300(R); No Copyright; Avail: CASI; A99, Hardcopy

The Annual Progress Report documents all research protocols, both new and continuing, reviewed during FY 02 by the Clinical Investigation Committee (CIC) and the Human Use Committee/ Institutional Review Board (HUC/IRB) of Walter Reed Army Medical Center (WRAMC) Continuing research review is administered by the Research Review Service (RRS), Department of Clinical Investigation (DCI), WRAMC. A detail summary sheet of each protocol giving the objective, technical approach, and progress is presented. Personnel rosters, DCI accomplishments, funding information, and known publications and presentations by the WRAMC professional staff are listed for FY 02.
DTIC
Medical Science; Clinical Medicine

20030108519 Rhode Island Hospital, Providence, RI, USA
Evaluation of GPR30 a Novel Estrogen Receptor for Assessing Responsiveness to Anti-Estrogen Therapy
Filardo, Edward J.; Jun. 2003; 42 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0419
Report No.(s): AD-A417301; No Copyright; Avail: CASI; A03, Hardcopy

Antiestrogens are the most effective and widely administered therapy for the management of breast cancer. Their efficacy has been attributed to their ability to antagonize the estrogen receptor, and the presence of ER in breast tumor biopsy specimens correlates well with responsiveness to antiestrogen therapy. Still, one in four patients with ER-positive tumors do not respond to antiestrogens, while one in six patients with ER-negative breast tumors undergo objective tumor regression following antiestrogen therapy (Witliff, 1934). These clinical observations suggest that alternative mechanisms of estrogen action may regulate the growth and survival of breast tumors. We have provided evidence that estrogen acts independently of the known estrogen receptors, ERalpha and ER%, via the G- protein coupled receptor, GPR3O, to regulate the EGFR-to-MAP K signaling axis (Filardo et al, 2000; reviewed in Filardo, 2001; Filardo et al, 2001). Moreover, we have shown that the antiestrogens, tamoxifen and faslodex (ICI 182, 780), also trigger GPR30- dependent regulation of this HE-EGF autocrine loop. Dysregulation of the EGFR-to-MAP K signaling axis is a common occurrence in breast cancer (Slamon et al, 1989, Sivaraman et al, 1997). The subject of this DOD award is to investigate the relationship between GPR30 expression and MAP K activity in breast tumor biopsy specimens obtained at first diagnosis or following antiestrogen or other adjuvant therapies. The results of these studies may lead to a further refinement in assessing responsiveness to antiestrogen therapy.
DTIC
Cancer; Estrogens; Mammary Glands

20030108553 Cardiology Research Center, Moscow, Russia

Host and Environmental Factors Influencing the Manifestation and Propagation of the Yeast Prions

Ter-Avanesyan, Michael D.; Jul. 2003; 25 pp.; In English

Contract(s)/Grant(s): N62558-02-M-5868

Report No.(s): AD-A417185; R&D-9263; XB-NAREGCOC/2W; No Copyright; Avail: CASI; A03, Hardcopy

The artificial prion PSI+ based on a hybrid Sup35PS with prion domain from the yeast Pichia methanolica PSI+(ps) was used to search a multicopy Saccharomycetes cerevisiae genomic library for novel factors able to cure prions. It was found that overexpression of the Hsp40 family chaperones Sis1 and Ynl077w, chaperone Sti1, transcriptional factors Sfl1 and Ssn8 and acidic ribosomal protein Rpp0 interfere with propagation and manifestation of the PSI+ prion. This implies that similar factors may be active against human and animal prion and amyloid diseases.

DTIC

Proteins; Genes; Yeast; Veterinary Medicine

20030108639 Baylor Coll. of Medicine, Houston, TX

Involvement of 53BP1, a p43 Binding Protein, in Chk2 Phosphorylation of p53 and DNA Damage Cell Cycle Checkpoints

Wang, Bin; Elledge, Stephen J.; May 2003; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0291

Report No.(s): AD-A417278; No Copyright; Avail: CASI; A03, Hardcopy

53BP1 binds to the tumor suppressor protein p53 and has a potential role in DNA damage responses. We used small interfering RNA (siRNA) directed against 53BP1 in mammalian cells to demonstrate that 53BP1 is a key transducer of the DNA damage checkpoint signal. 53BP1 was required for p33 accumulation, G2-M checkpoint arrest, and the intra-S- phase checkpoint in response to ionizing radiation. 53BP1 played a partially redundant role in phosphorylation of the downstream checkpoint effector proteins Brca1 and Chk2 but was required for the formation of Brca1 foci in a hierarchical branched pathway for the recruitment of repair and signaling proteins to site of DNA damage.

DTIC

Proteins; Phosphorylation

20030108642 Wisconsin Univ., Madison, WI

Mapping Genetic Modifiers of Mammary Tumor Susceptibility

Moser, Amy R.; Nov. 2002; 23 pp.; In English

Contract(s)/Grant(s): DAMD17-99-1-9454

Report No.(s): AD-A417279; No Copyright; Avail: CASI; A03, Hardcopy

Mutations in APC/Apc predispose both humans and mice to multiple polyps of the colon and small intestine Min/+ mice carry a mutation at Apc and are predisposed to developing spontaneous intestinal and mammary tumors. On a C57BL/ 6J (B6) background Min/+ mice develop spontaneous mammary tumors at a 5% rate. When injected with ENU (ethylnitrosourea) over 80% of B6 Min/+ female mice develop mammary tumors. 1 29/SvJ x B6 F1 mice that carry the Min mutation are resistant to mammary tumor development after ENU treatment. We produced backcross mice in order to map the modifier loci causing resistance in the (129/ SvJ x B6) mice. Preliminary analysis of SSLP markers spaced every 20-25 cM throughout the genome indicates the possibility of two regions that contain modifiers. One region maps to chromosome 6 near the marker D6Mit36. A congenic line ROSA26, carrying this region on chromosome 6 from 129 on a B6 background had already been established. ROSA26 mice have a LacZ insertion flanked by 129 DNA in the modifier region on chromosome 6. ROSA26 x B6 F1 Min/+ mice are resistant to mammary tumors following ENU treatment. The ROSA26 mice will be used to study the biological effects of the potential modifier.

DTIC

Mammary Glands; Genetics

20030108681 Johns Hopkins Univ., Baltimore, MD

Collection of Prostate Cancer Families and Mapping Additional Hereditary Prostate Cancer Genes (HPC2, HPC3,...)

Isaacs, William B.; Apr. 2003; 121 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-98-1-8469

Report No.(s): AD-A417342; No Copyright; Avail: CASI; A06, Hardcopy

Our initial genome wide search for linkage in multiplex prostate cancer families implicated 1q24-25 as harboring a major

prostate cancer susceptibility gene (HPC1), although there was significant evidence for locus heterogeneity and at least 5 other loci were implicated as the sites of HPC genes. Using families ascertained in Phase I of this project, an additional HPC locus located at Xq27-28 (HPCX) was identified. Furthermore we obtained strong preliminary evidence of an additional novel HPC locus on chromosome 8 that may account for up to 20% of all HPC families. To continue and extend these analyses towards the identification of the HPC genes on chromosomes X and 8, we proposed to narrow the gene-containing regions on Xq and 8p (from ^20 cM to 1-2 cM) using a variety of approaches including association studies in family and population based sample, and to assess candidate genes in regions delineated by these approaches by mutation screening. Our main focus has been on chromosome 8 where a number of candidate genes have been evaluated. Importantly, one gene, MSR1 at 8p22, was found to harbor clearly inactivating mutations, and other cancer- associated variants in HPC families and non-HPC cases. These results implicate for the first time genetic variation affecting macrophage function as an important determinant of inherited susceptibility for prostate cancer.
DTIC
Genes; Genetics; Cancer

20030108692 Virginia Mason Research Center, Seattle, WA
Development of a Transgenic Mouse Model for Breast Cancer that is Optimized for the Study of T Cell-Based Therapeutic Strategies
Nelson, Brad H.; Jun. 2003; 9 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0486
Report No.(s): AD-A417372; No Copyright; Avail: CASI; A02, Hardcopy

Our goal is to develop a transgenic mouse model for breast cancer that will allow the in vivo activities of tumor-specific T cell clones to be tracked at all stages of tumorigenesis and after various immune interventions. We proposed to 'tag' the neu oncogene with two defined T cell epitopes so as to confer recognition by available T cell receptor (TCR) transgenic T cells.
DTIC
Cancer; Mammary Glands; Cells (Biology)

20030108766 National Jewish Medical and Research Center, Denver, CO, USA
Dissecting Immunogenicity of Monoclonal Antibodies
Snyder, Christopher M.; Wysocki, Lawrence J.; Jun. 2003; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0359
Report No.(s): AD-A417364; No Copyright; Avail: CASI; A03, Hardcopy

The potential of monoclonal antibodies, (mAbs), for use in therapeutic and diagnostic applications has not been fully realized in part due to counter-immune responses that often arise in patient recipients of mAb. A growing research effort to 'humanize' mAb has focused primarily on the structure or sequence of the antibody variable (V) region domains. However, these approaches may ultimately suffer, as they overlook the requirement of T cell help for the immune counter-reaction and the potential of somatic hypermutation and V-D-J recombination to generate target T cell epitopes within mAb V regions. My approach focuses on this issue. In order to understand seine basic principals concerning anti-immunoglobulin immune responses, I have developed a panal of T cell hybridomas, new transgenic mice and a tetrameric staining reagent. Studies with these tools strongly support our basic hypothesis that T cells are tolerant of endogenous immunoglobulin-derived diversity. I have also obtained a panal of T cell hybridomas that are specific for the CDR3 region of a monoclonal antibody supporting our hypothesis that junctional diversity may provide a source of T cell epitopes within a monoclonal antibody. Finally, I have addressed the global nature of T cell responses to junctional diversity with an adoptove transfer system.
DTIC
Antibodies; Dissection; Immunology; Physiological Responses

20030108773 California Univ., Los Angeles, CA
Role of Androgen Receptor in Growth of Androgen Independent Prostate Cancer
Chen, Charlie D.; Jan. 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0024
Report No.(s): AD-A417515; No Copyright; Avail: CASI; A02, Hardcopy

Androgen-ablation therapy is the primary treatment for prostate cancer that has escaped local control through surgical excision or radiation (hormone sensitive, HS). While generally effective, the treatment is short-lived and hormone refractory (HR) cancer eventually develops. To identify the responsible mechanisms, we set out a microarray experiment using seven

pairs of HS and HR xenografts and identified androgen receptor (AR) overexpression is the only consistent change in the progression of prostate cancer. In the last grand period, I confirmed by western blot analysis that androgen receptor protein is higher in HR than HS tumors. Through lentivirus and retrovirus systems, I was able to overexpress AR in both LNCaP and LAPC4 cells. In vitro and in vivo experiments demonstrated that overexpression of AR is sufficient for HS-to-HR transition. We are testing if AR is necessary for the growth of androgen independent prostate cancer
DTIC
Cancer; Prostate Gland; Refractories; Growth; Physiology

20030108782 Mayo Clinic, Scottsdale, AZ, USA
The Role of MUC1 Cytoplasmic Domain in Tumorigenesis
Al-Masri, Azzah; Gendler, Sandra J.; May 2003; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0476
Report No.(s): AD-A417517; No Copyright; Avail: CASI; A03, Hardcopy

MUC1 is a large, heavily O-glycosylated membrane mucin that is normally expressed on the apical surface of most simple secretory epithelia and several hematopoietic cells 1-3. More than 90% of human breast carcinomas and metastases overexpress aberrantly glycosylated MUC1 4. Moreover, in most adenocarcinomas MUC1 expression is not restricted to the apical surface 5. MUC1 has been identified as an important tumor antigen, however the precise function of MUC1 in tumorigenesis and disease progression remains undefined. Numerous observations point to a role for MUC1 in signal transduction. The 72 amino acid tail of MUC1 contains 7 tyrosines, 6 of which are 100% conserved across the species 6. The cytoplasmic tail of MUC1 has been shown to be phosphorylated on tyrosine residues in epithelial cell lines and mouse mammary gland 7-9. The cytoplasmic tail of MUC1 contains potential docking sites for SH2 containing proteins and a number of possible kinase recognition sites 6.
DTIC
Neoplasms; Cancer; Mammary Glands; Hematopoietic System

20030108785 Iowa Univ., Iowa City, IA
Molecular Mechanisms of Breast Cancer Metastasis
Wallrath, Lori L.; May 2003; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0424
Report No.(s): AD-A417529; No Copyright; Avail: CASI; A03, Hardcopy

Metastasis accounts for the majority of deaths associated with breast cancer. There is a need to identify prognostic/ predictive indicators to accurately determine whether breast cancer cells are likely to metastasize. Hp1(Hs alpha) (Heterochromatin Protein 1) has been identified as a candidate breast cancer metastasis suppressor that is down- regulated in highly invasive/ metastatic breast cancer cells compared to poorly invasive/non-metastatic cells. HP1(Hs alpha) is a non-histone chromosome protein that plays a role in chromosome segregation, chromatin packaging, and gene silencing.
DTIC
Cancer; Mammary Glands; Molecular Biology; Metastasis

20030108815 Wake Forest Univ., Winston-Salem, NC, USA
Blocking Internalization of Phosphatidylethanolamine at Cleavage Furrow of Mitosis as a Novel Mechanism of Anti-Breast-Cancer Strategy
Cui, Zheng; Jun. 2003; 4 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0665
Report No.(s): AD-A417523; No Copyright; Avail: CASI; A01, Hardcopy

During the formation of cleavage furrow of mitosis, phosphatidylethanolamine (PE) flips from inner leaflet of the plasma membrane to the outer leaflet specifically in the furrow region near the contractile ring. Immediately after the contractile ring separates the two daughter cells, PE returns from outer leaflet to inner leaflet. This transient movement of PE during cytokinesis is essential because blockage of this PE movement results in a failure of mitosis and leads to cell death. Cinnamycin produced by Streptoverticillium griseoverticillatum targets specifically to PE on cell surface at the cleavage furrow of mitotic cells but not the non- dividing cells. This proposal is to test if cinnamycin is a better anti-tumor drug for treatment of breast cancers because of several advantages: 1) Cinnamycin only targets proliferating cells but has no effect on non-proliferating cells. 2) The anti-proliferation activity doesn't require cinnamycin to enter the cells. 3) Cinnamycin doesn't have to suffer the effect of multi-drug resistance mechanism or cellular metabolism. Because cinnamycin is no longer available

commercially, we had to devise production procedures and to purify this compound in our own lab. Thus, completion of this proposal would require longer time than that was originally proposed.
DTIC
Cancer; Chemotherapy; Drugs; Mammary Glands; Membranes

20030108923 Case Western Reserve Univ., Cleveland, OH
Exploiting and NQ01-Directed, Calpain-Medicated Apoptotic Pathway for Breast Cancer Therapy
Wagner, Mark W.; Boothman, David A.; Apr. 2003; 92 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0194
Report No.(s): AD-A417425; No Copyright; Avail: CASI; A05, Hardcopy

The purpose of this proposal was to further understand the molecular mechanisms of beta-lap-induced apoptosis, and its ability to target cancer over normal cells. We believe that beta-lap induces apoptosis through changes in intracellular calcium homeostasis and micron-calpain activation. This will be tested via two specific aims using NQ01-expressing and non-expressing (beta-lap sensitive and resistant, respectively) MDA-MB-468 breast cancer cells as a model system. The first aim was to determine changes in intracellular calcium homeostasis before and after (beta-lap exposure. Fluorescence calcium dye indicators will be used to determine changes in intracellular calcium levels as well as GFP-calmodulin calcium indicators (cameleons, that are targeted to intracellular organelles), for a more accurate determination of where calcium changes are occurring. Analysis of apoptosis via flow cytometric analyses will be performed in breast cancer cells in the presence of extracellular calcium chelators, to determine if changes in intracellular calcium concentrations are critical for DNA fragmentation and cell death. The second aim will be to determine the role of calpain and its downstream targets in (beta-lap-induced apoptosis. Calpain activation will be assessed using fluorogenic substrates. Substrate cleavage analyses, in vitro, will be performed using specific downstream targets, as determined from western blot timecourse analyses (PARP, lamin B, and p53). Confocal microscopy with indirect immunofluorescence and Green Fluorescent Protein (OFP)-tagged micron-calpain will be used to examine calpain translocation and co-localization studies with downstream targets.
DTIC
Apoptosis; Cancer; Mammary Glands; Therapy

20030108930 California Univ., San Diego, La Jolla, CA
Coactivators and Corepressors in Breast Development and Receptor-Dependent Tumorigenesis
Bassets, Ivan G.; Lee, Soo-Kyung; Jun. 2003; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0185
Report No.(s): AD-A417426; No Copyright; Avail: CASI; A03, Hardcopy

Estrogens are important regulators of growth and differentiation in the normal mammary gland and are also important in the development and progression of breast carcinoma. Estrogens regulate gene expression via estrogen receptor (ER) protein and, because approximately two-thirds of all breast cancers are ER+ at the time of diagnosis, the expression of the receptor has important implications for their biology and therapy. ER binds to the estrogen response element (ERE) found in the promoters of estrogen- regulated genes and activates their transcription. Several co-factors (coactivators and corepressors) have been identified that are of importance in regulating the ER interaction with the basal transcription machinery. Herein, we will address the role of specific cofactors in ER action and the rules that govern the specific recruitment of these proteins to specific promoters.
DTIC
Cancer; Mammary Glands; Therapy; Estrogens

20030108945 Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM
Transcriptional Regulation of VEGF Expression in Breast Cancer
Bredow, Sebastian; Jun. 2003; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0297
Report No.(s): AD-A417429; No Copyright; Avail: CASI; A03, Hardcopy

To identify promoter elements and transcription factors that contribute to enhanced expression of Vascular Endothelial Growth Factor (VEGF) in breast cancer, reporter constructs, encompassing nested deletions approximately every 100 base pairs (bp) of the wild type (wt)-promoter (-1175 to +50) were synthesized and screened for activity by transient transfection in human breast cancer and mom-mammary cells. In most cells, a drop of > 40% in transcriptional activity was observed under normoxic conditions when sequences between positions -1175 and -1010 were deleted. Sequences downstream of the

hypoxia-regulatory element (HRE) at position -971 modulate activity in a tissue- and cell type-specific manner: deletion of sequences between positions -900 and -790 reduces promoter activity another 30%, indicating differences in transcriptional regulation among tissues and within the same cell type. Electrophoretic mobility shift assays (EMSA) revealed that transcription factor Spl, but not AP-2 or Egr-1, binds the basal promoter element upstream of the transcriptional start site between positions -85 and -50.
DTIC
Endothelium; Genetics; Cancer; Mammary Glands; Hypoxia

20030109053 Temple Univ., Philadelphia, PA
Role of c-myb in Breast Development and Cancer
Lieu, Yen; Reddy, Premkumar E.; Jun. 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0452
Report No.(s): AD-A417398; No Copyright; Avail: CASI; A02, Hardcopy

C-MYB, ALONG WITH A-myb and B-myb, belongs to the myb gene family which codes for nuclear proteins that bind DNA in a sequence-specific manner and function as regulators of transcription. There is a large body of evidence to suggest a role for c-myb in breast development and cancer. c-myb is highly expressed in all estrogen receptor positive (ER+) breast tumors as well as ER+ mammary carcinoma cell lines. In addition, our in situ hybridization studies show that c-myb is expressed at high levels in ductal cells from breast tissues of virgin and pregnant mice. To address the role of c-myb in mammary development and cancer, we have created c-myb conditional knockout mice where the expression of this gene is interrupted specifically in the mammary gland using the Cre- lox system. To date, we have generated two female mice that are homozygous for the c-myb floxed alleles (conditional deletion alleles), and additionally, one of the two female mice bears the WAP-cre transgene while the other carries the MMTV-cre transgene. The generation of these breast-specific c- myb conditional knockout mice will afford us the opportunity to dissect the role of c-myb in normal breast development and cancer.
DTIC
Cancer; Mammary Glands; Tumors

20030109056 California Inst. of Tech., Pasadena, CA
Evolution by Structure-Based Protein Recombination
Arnold, Frances H; Jun. 2003; 4 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0391
Report No.(s): AD-A417404; ARO-41082.2-LS; No Copyright; Avail: CASI; A01, Hardcopy

The computational algorithm SCHEMA was developed to estimate the disruption caused when amino acid residues that interact in the three-dimensional structure of a protein are inherited from different parents upon recombination. If the folded structure is retained, the new chimeric sequences can display functional properties characteristic of the parents; they can also acquire entirely new functions. We are using SCHEMA to design chimeras of cytochrome P450 heme enzymes. In a preliminary study of 17 chimeras, we observed significant functional diversity: chimeras displayed altered substrate specificity profiles, a wide range in thermostabilities, up to a 40-fold increase in peroxidase activity, and ability to hydroxylate a substrate towards which neither parent shows detectable activity. SCHEMA-guided recombination can generate diverse sequences for exploring the evolution of function within a given protein structural framework.
DTIC
Proteins; Amino Acids

20030109057 New Mexico Univ., Albuquerque, NM
Elastin: A Stimuli Responsive Biopolymer for Nano-, and Micro-Actuation
Lopez, Gabriel P.; Goparaju, Venkata R.; Fu, Qiang; Balamurugan, S.; Mendez, S.; Nov. 2002; 9 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0183
Report No.(s): AD-A417653; No Copyright; Avail: CASI; A02, Hardcopy

We developed hybrid materials comprising of silica and stimuli responsive polymers (SRPs) to demonstrate the feasibility of SRPs as actuation elements in functional nanostructured materials. We successfully demonstrated that the hybrid membranes comprising of silica and SRPs can function as molecular filters with reversible permeability and good stability. We dispersed these SRPs in a slilica matrix at a molecular level using sol-gel process. The encapsulated SRP molecules to act as nano- valves whose permeability can be controlled by cycling through the lower critical solution temperature (LCST) of the SRPs. Micropatterning studies on hybrid membranes suggest that a wide variety of water-soluble species can be patterned

without need for a specific chemisorption or affinity label using localized heating with a UV laser. Developed porous silica nanocomposite materials and modified the surface with SRPs using atom transfer radical polymerization and demonstrated that the size and surface energy of the pores can be externally and reversibly controlled to dynamically modulate the adsorption and transport of molecular species. These have potential applications in the areas of separations, controlled drug delivery, environmental remediation, bioassays, biosensing, tissue engineering. Using a model system of silica and PNIPAAM we have demonstrated design principles and synthetic methods are applicable to a wide variety of porous structures and polymers (or small molecules) which are reversibly sensitive to different external stimuli such as temperature, light, electricity, pH, solutes, or enzymatic transformations.
DTIC
Polymers; Nanocomposites; Porous Materials

20030109060 George Washington Univ., Washington, DC
Naked DNA Immunization for Prevention of Prostate Cancer in a Dunning Rat Prostate Tumor Model
Mincheff, Milcho S.; Jun. 2003; 30 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0239
Report No.(s): AD-A417656; No Copyright; Avail: CASI; A03, Hardcopy

We cloned into a pVax expression vector the secreted and the truncated (no peptide leader sequence) versions of the human prostate acid phosphatase (H-PAP-T), the human prostate-specific antigen (H-PSA-T) and the rat analogue of the human PSMA (R-'PSMA'-S). A stable transfectant with H-PSMA and H-PSA of the AT3B1 cell line was obtained. The following plasmids were produced and purified under GLP- conditions using the Qiagen technology: H-PSMA-T, R-'PSMA'-T, H-PSA, H-PSA-T, H-PAP-T and R'PSMA'-S. Preliminary studies using the Copenhagen rat tumor prostate model showed uniform tumor development in rats that were injected subcutaneously with 100 000 AT3B-lPSMA,PSA cells. Using a commercially available transfection device from Amaxa, we could transfect differentiated dendritic cells with 20-40% efficiency. Such transfected dendritic cells stimulated in vitro autologous T cells to PSMA. T cells cytotoxicity was then tested against tumor cells or peptide-pulsed T2 target cells. Both H-PSMA-T DCs and S-PSMA DCs generated antigen-specific cytotoxic T cell responses. The immune response was restricted towards one of four PSMA derived epitopes when priming and boosting was performed with S-PSMA. In contrast, T-PSMA transfected DCs primed T cells towards several PSMA derived epitopes. Subsequent repeated boosting with transfected DCs restricted the immune response to a single immunodominant epitope.
DTIC
Antigens; Cancer; Immune Systems; Immunity; Prostate Gland; Rats; Deoxyribonucleic Acid

20030109069 Fox Chase Cancer Center, Philadelphia, PA, USA
Identification of Candidate Breast Cancer Susceptibility Genes Using a cDNA Microarray/CGH Approach
Godwin, Andrew K.; May 2003; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0521
Report No.(s): AD-A417397; No Copyright; Avail: CASI; A03, Hardcopy

Familial breast cancer accounts for 15 to 35% of all breast cancers. Mutations in a number of genes are now known to cause susceptibility to breast cancer; the most notorious are the BRCA1 and BRCA2 genes. However, it has become evident that not all (or even the majority) of familial breast cancer families can be attributed to mutations in BRCA1 and BRCA2. In a recent study by the Breast Cancer Linkage Consortium, only one third of families with four or five cases of female breast cancer and no cases of ovarian cancer carry mutations in either BRCA1 and BRCA2. Smaller familial clusters are much more common than families with large numbers of cases, suggesting that a substantial proportion of familial clustering is not accounted for by mutations in BRCA1 and BRCA2; therefore, there is a great need to discover other genes that contribute to this disease. We hypothesize that a heterozygous deletion in constitutive DNA or a homozygous deletion in multiple tumors and tumor types from a cancer- prone family will represent a strong candidate cancer predisposing gene. To establish this proof of principle, we have successfully developed a fluorescent-based DNA microarray assay to identify deletions, as small as a single exon, in heterogeneous tumor DNA.
DTIC
Cancer; Mammary Glands; Mutations

20030109082
Molecular Basis of Genomic Instability in Breast Cancer: Regulation of the Centrosome Duplication Cycle
Du, Jian; Hannon, Gregory; Jun. 2003; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0344
Report No.(s): AD-A417655; No Copyright; Avail: CASI; A03, Hardcopy

Alteration in the expression and activity of the centrosomal kinase in breast cancers, Aurora-A/STK15, affect genomic stability, disrupt the fidelity of centrsome duplication, and induce cellular transformation. We followed the proposal tasks (1 and 2) to providence that p160ROCK, aRho- associate Serine/ Threonine kinase, associates with STK15 in a protein complex with other SAFs (STK15-associated-factors) and is phosphorylated by STK15 in vivo. Suppression of STK15 by siRNA in Hela cells blocks the ability of centrosomes to organize normal mitotic spindles, induces G2/M arrest and promotes accumulation of tetraploid cells.
DTIC
Cancer; Mammary Glands

20030109111 Pittsburgh Univ., Pittsburgh, PA
Prospective Evaluation of Hormone Replacement Therapy, Body Mass Index, Estrogen Metabolism and Breast Cancer Risk
Modugno, Francesmary; Jul. 2003; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0550
Report No.(s): AD-A417504; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this project is to prospectively evaluate the extent to which BMI and estrogen metabolism are related to breast cancer associated with HRT use. We will specifically test the following hypotheses: Among postmenopausal women using HRT: a). the risk of breast cancer is higher for women with higher serum 16-OH levels b). lower BMI is associated with higher serum 16-OH levels c). therefore: the risk of breast cancer increases with decreasing BMI We will also test the relationship between serum 2-OH levels, the 2:16-OH ratio, BMI and breast cancer risk. This will be done using a nested case/control study within the observational arm of the Womens Health initiative.
DTIC
Cancer; Mammary Glands; Hormones; Estrogens

20030109113 Cedars-Sinai Medical Center, Los Angeles, CA
Interaction of BRCA1 and p27Kipl Pathway in Breast Cancer
O'Kelly, James L.; May 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0337
Report No.(s): AD-A417508; No Copyright; Avail: CASI; A02, Hardcopy

Women who have familial breast cancer often have a germline mutation of the breast cancer susceptibility gene known as BRCA1. The function of BRCA1 is not totally understood. Previously, immunochemical analysis of a series of breast cancer cell lines demonstrated a correlation between the expression of p27(kipl) (kipl) and BRCA1. The p27kipl is a member of the universal cyclin-dependent kinase inhibitor family. BRCA1 has a number of activities including DNA repair, growth inhibition, and as a transcription factor. Here we demonstrate that BRCA1 transactivates expression of p27kipl. This transactivation is dependent on - the presence of a functional C-terminal transactivation domain. Promoter- deletion analysis identified the presence of a putative BRCA1- responsive element located at position -615 to -511 of the p27(kipl) promoter.
DTIC
Cancer; Mammary Glands; Enzyme Activity; Females

20030109115 Illinois Univ., Chicago, IL
Novel Membrane-Associated Targets for Diagnosis and Treatment of Breast Cancer
Mar, Brenton G.; Westbrook, Carol A.; May 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0411
Report No.(s): AD-A417511; No Copyright; Avail: CASI; A02, Hardcopy

Proteins localized to the cell membrane or secreted show great promise as therapeutic targets and diagnostic markers because of their easy accessibility. However, determining protein localization by traditional methods is a difficult process. A 'feature' of membrane-bound and secreted proteins can be exploited to determine their membrane-bound status on a large scale. Because the mRNA transcripts of membrane-bound and secreted proteins are translated in polysomes bound to the

endoplasmic reticulum (ER), they can be separated from their heavier cytosolic counterparts by sucrose gradient centrifugation. At the end of year one of this project, we have reproducibly separated the RNA of MCF7 cells into two fractions using this method. Realtime RT-PCR analysis of two test genes shows enrichment of the RNA encoding cytoplasmic GAPDH in the expected fraction, and an enrichment of the RNA encoding membrane-localized JAM in the membrane fraction. Although we have experienced some difficulty in increasing RNA yield, we are confident we will soon have enough RNA to hybridize to Affymetrix chips, so that we may continue this identification on a large scale. Combined with breast cancer expression and amplicon data, this could allow for the identification of potential novel membrane-bound and secreted drug targets and markers.
DTIC
Cancer; Mammary Glands; Diagnosis

20030109300 Chicago Univ., Chicago, IL
Modulation of Ras Signaling by NF1 and CRKL in Development
Imamoto, Akira; Jun. 2003; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0639
Report No.(s): AD-A417670; No Copyright; Avail: CASI; A03, Hardcopy

Mutations in the NF1 gene are the genetic basis of neurofibromatosis type I, a common genetic disorder which predisposes the patient to neoplasia in the peripheral nervous system as well as other tissues. The NF1 gene encodes a protein called neurofibromin that negatively regulates the small G-protein Ras. Abnormal activation of Ras can cause sustained cell survival and growth in some cells. Ras and other small C-proteins like it are believed to relay critical messages from the cell's environment to the cell nucleus where this information is processed. Crkl (Crk-like) encodes an adapter protein that has been implicated in bridging such messages to small C-proteins like Ras. We have proposed to study the biological role of Crkl during development in conjunction with NF1 and to determine the role of Crkl in regulation of Ras signaling.
DTIC
Genetics; Mutations; Diseases; Neurology

20030109304 Johns Hopkins Univ., Baltimore, MD
HOXB7: An Oncogenic Gene in Breast Cancer Cells?
Rubin, Ethel; Sukumar, Saraswati; May 2003; 17 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0426
Report No.(s): AD-A417673; No Copyright; Avail: CASI; A03, Hardcopy

Homeobox genes control anterioposterior body axis patterning during development. Although expressed primarily in developing embryos, a growing body of evidence shows that homeobox gene re-expression in adult tissues is associated with tumorigenesis. Earlier work has shown that introduction of HOXB7, one of the members of this gene family, into non-expressing breast cancer cells induced expression of a number of pro-angiogenic factors and formed tumors upon xenograft into nude mice. We had earlier identified HOXB7 as an overexpressed gene in a SAGE analysis of breast cancer cell lines and wanted to investigate its oncogenic potential in this study.
DTIC
Cancer; Carcinogens; Mammary Glands; Oncogenes; Cells (Biology)

20030109307 Claflin Coll., Orangeburg, SC
Role of Zinc in the Pathogenesis of Prostate Cancer
Bagasra, Omar; May 2003; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0233
Report No.(s): AD-A417674; No Copyright; Avail: CASI; A03, Hardcopy

Incidence rates of prostate cancer are higher in blacks than in any other racial group. Our laboratory is attempting to decipher the environmental and molecular mechanisms involved in the development of prostate cancer in blacks. It is hypothesized that Africans may have genetically down-regulated their zinc absorption capacity; otherwise, they would absorb abnormally high levels of zinc, resulting in various serious neurodegenerative disorders. We hypothesized that people of African origin may have a lower capacity to absorb zinc when compared with other racial groups because of their inherent down-regulation of zinc transporters. This notion was tested by evaluating 58 prostate cancer tissues in 2 major racial groups (30 from whites and 28 from blacks) for their ability to express 2 major human zinc transporters, hZIP1 and hZIP2. In all 30 prostate cancer specimens obtained from white people, the degree of expression of these 2 zinc receptors was high when

compared with age-matched specimens obtained from blacks. Once these data are confirmed in larger groups, this finding could have significant application as a preventive maneuver for at least for some people. Because dietary zinc supplements are relatively nontoxic, any efficacy trial would be low-risk.
DTIC
Cancer; Pathogenesis; Prostate Gland; Zinc; Race Factors

20030109308 Institute of Critical Care Medicine, Palm Springs, CA, USA
Quantitative Mechanistic Modeling of Sublingual PCO2 as an Index of Severity and Resuscitation Success
Weil, Max H.; Sep. 2003; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0696
Report No.(s): AD-A417675; No Copyright; Avail: CASI; A03, Hardcopy

The goal of our task for the first year was to investigate whether the changes in sublingual PCO2 reflect changes in tissue blood flow during hemorrhage and hemorrhagic shock. Hemorrhagic shock was induced by a modification of Wigger's method in male domestic pigs weighting 35 to 40 kg. Sublingual PCO2 increased from 60 to 129 mmHg in parallel with average decreases in cardiac output to 44% and mean arterial pressure to 47% decreases in EtCO2 from 35 to 28 mmHg together with increases in arterial blood lactate concentrations from 0.7 to 7.8 mmol/l over the two-hour interval of shock. Utilizing colored microspheres for measurements, siblingual blood flow decreased to 34% liver flow to 56% and renal flow to 47%. After reinfusion of shed blood, sublingual PCO2 was restored to approximately baseline values together with arterial pressure, cardiac output and EtCO2, but there was delayed reversal of lactic acidosis. In control animals, no significant changes were observed over the same time interval. Increases in sublingual PCO2, is accompanied by proportionate decreases in sublingual and vital organ blood flows. Our study supports the rationale for non-invasive measurements of sublingual PCO2 for diagnosis and quantitation of the severity of hemorrhagic shock.
DTIC
Resuscitation; Mathematical Models; Human Pathology; Gastrointestinal System

20030109312 Duke Univ., Durham, NC
Definition of the Molecular Mechanisms Which Distinguish Between Selective Estrogen Receptor Modulators (SERMs) and Full Antiestrogens
Huang, Huey-Jing; May 2003; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0371
Report No.(s): AD-A417684; No Copyright; Avail: CASI; A03, Hardcopy

Tamoxifen, a SERM (Selective Estrogen Receptor Modulator), is the most commonly used endocrine treatment for all stages of breast cancer. However, progression from tamoxifen sensitivity to tamoxifen resistance occurs in a substantial portion of the tumors. Full antiestrogens, such as ICI 182,780, are currently used as the second line therapy after failure of long-term tamoxifen therapy. To facilitate the design and characterization of more appropriate therapeutic agents for endocrine therapy of breast cancer, it is very important to understand the functional mechanisms that distinguish full antiestrogens from SERMs.
DTIC
Endocrinology; Estrogens; Modulators; Receptors (Physiology); Mammary Glands; Cancer

20030109313 Johns Hopkins Univ., Baltimore, MD
Endourethral MRI Guidance for Prostatic RF Ablation
Atalar, Ergin; Jun. 2003; 43 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0064
Report No.(s): AD-A417686; No Copyright; Avail: CASI; A03, Hardcopy

Prostate cancer constitutes a major health problem. Although the medical techniques currently in use to diagnose prostate cancer are successful, the methods to stage the cancer and visualize the invasion and spread of the cancer are inadequate. MRI is known to be the best method for staging but it does not offer image resolution that is acceptable, especially for detecting disease in the anterior prostate. In the first year of the project, we have developed a phased array coil setup that enabled us imaging of the prostate with 160 microns image resolution. The second year, we have developed a mechanical setup that enabled placement of the needles in the prostate with 1mm accuracy. Both of these are published in high impact journals. Developed methods for imaging temperature changes in the prostate with high accuracy. In the last year of the project, we will

test the performance of this setup on animals in precise RF ablation of the prostate.
DTIC
Ablation; Cancer; Prostate Gland; Radio Frequencies; Urology; Imaging Techniques; Magnetic Resonance

20030109315 Northern California Inst. for Research and Education, San Francisco, CA
Characterization of SIRPs in Prostate Cancer Cells
Seaman, William E.; Mar. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0095
Report No.(s): AD-A417693; No Copyright; Avail: CASI; A02, Hardcopy

Signal regulatory proteins (SIRPs) include SIRP beta 1%, which activates cells, and SIRP alpha 1, which inhibits the cellular response to several growth factors, and which regulates cell adhesion and spreading. We demonstrated by PCR that 3 of 3 prostate cancer cell lines (PC-3, DU-145 and LNCaP) express transcripts for SIRPs. Under this contract, we generated a monoclonal antibody that recognizes both SIRP beta 1 and SIRP alpha 1, thereby confirming the expression of SIRPs on PC-3 cells and, to a lesser extent on DU-145 cells. The receptor could not be detected on cells.
DTIC
Cancer; Prostate Gland; Proteins; Signal Transmission; Cells (Biology)

20030109318 South Carolina Univ., Columbia, SC, USA
Effects of Nationally-Occurring Estrogen-Fatty Acid Esters on Mammary Cell Growth and Carcinogenesis in Female Rats
Mills, Laura H.; Zhu, Bao T.; Jun. 2003; 54 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0567
Report No.(s): AD-A417683; No Copyright; Avail: CASI; A04, Hardcopy

My studies have compared the carcinogenic effects of an E(2)-17 beta-fatty acid ester preparation, E(2) and 4-OH- E(2) in the breast, pituitary and uterus of ACI rats. Results showed that chronic administration of an E(2)-17 beta-fatty acid ester preparation to these rats preferentially induces the development of mammary tumors while chronic administration of E(2) results in the preferential formation of pituitary tumors. The chronic administration of 4-OH-E(2) to intact female ACI rats did not induce the formation of mammary or pituitary tumors, although there was hyperplasia present in the mammary glands. These results are the first report demonstrating that chronic administration of an estrogen fatty acid ester selectively induces the development of mammary tumors in this animal model. In order to study the carcinogenic activity of other estrogen fatty acid esters, such as those of 4-OH-E(2), they must first be synthesized.
DTIC
Carcinogens; Cell Division; Fatty Acids; Mammary Glands; Estrogens; Rats; Females

20030109320 Mount Sinai Hospital, Toronto, Ontario, Canada
Characterization of the Interaction of BRCA1 and Protein Phosphatase 1
Hendry, Sherry L.; May 2003; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0496
Report No.(s): AD-A417685; No Copyright; Avail: CASI; A03, Hardcopy

The breast cancer susceptibility gene BRCA1 is mutated in many cases of familial breast and ovarian cancer. BRCA1 plays a role in DNA repair, centrosomal function, ubiouitination, and the transactivation of genes. The phosphorylation status of BRCA1 changes throughout the cell cycle, and upon DNA damage. Phosphorylation may, therefore, play an important role in the regulation of BRCA1 function.
DTIC
Proteins; Mammary Glands; Cancer; Oncogenes

20030109324 Naval Postgraduate School, Monterey, CA
A Feedback Perspective of Healthcare Demand/Supply Relationship and Behavior
Stolarik, Ladislav; Udomsilp, Phuwadol; Sangsub, Suriya; Jun. 2003; 83 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417699; No Copyright; Avail: CASI; A05, Hardcopy

The USA has experienced a dramatic growth both in technical capabilities and in its allocation of resources to the healthcare. Because of the aging population, the U.S. fears that demand for healthcare will outstrip available resources suggesting the need for adding more healthcare capacity. However, recent studies have found that more care may not

necessarily mean better health. These demonstrate that more hospitals in an area lead to more days spent in hospitals with no discernible improvements in health. Interestingly, supply tends to drive demand; more doctors and hospitals lead to more demand for services. This appears to be an unintended consequence or policy resistance to public policy. One contributor to this 'vicious' cycle is hospitals' competing for specialist affiliations, which in turn, compete for patients by offering specialized services. Apart from care retailing, hospitals tend to duplicate services and aggressively expand capacity when their competitors do. The objective of this MBA Project is to further explore the relationship between demand and supply of healthcare in the USA using the System Dynamics feedback loop perspective. Furthermore it discusses how System Dynamics and Systems Thinking fields of study facilitate understanding the behavior of complex of problem structures.
DTIC
Demand (Economics); Public Health

20030109342 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Ethical Issues in Health Research Involving Human Participants in Latin America and the Caribbean: Description of the Pan American Health Organization Ethical Review Committee Decisions and Practices
Fonseca-Rivera, Jose M.; Sep. 2003; 3 pp.; In English
Report No.(s): AD-A417721; C102-1287; No Copyright; Avail: CASI; A01, Hardcopy

There is growing discussion about the protection of human subjects in biomedical research in Latin America and the Caribbean. However, only a handful of studies have been published about the knowledge, application, and acceptance within the region of international ethical guidelines and standards for human subjects research.
DTIC
Caribbean Region; Central America; Health; Medical Science; Ethics; Research and Development

20030109362 Naval Postgraduate School, Monterey, CA
Policies for Biodefense Revisited: The Prioritized Vaccination Process for Smallpox
Kress, Moshe; Sep. 2003; 35 pp.; In English
Report No.(s): AD-A417598; NPS-OR-03-008; No Copyright; Avail: CASI; A03, Hardcopy

Handling bioterror events that involve contagious agents is a major concern in the war against terror, and is a cause for debate among policymakers about the best response policy. At the core of this debate stands the question which of the two post-event policies to adopt: mass vaccination-- where maximum vaccination capacity is utilized to uniformly inoculate the entire population, or trace (also called ring or targeted) vaccination--where mass vaccination capabilities are traded off with tracing capabilities to selectively inoculate only contacts (or suspected contacts) of infective individuals. We present a dynamic epidemic-intervention model that expands previous models by capturing some additional key features of the situation and by generalizing some assumptions regarding the probability distributions of inter-temporal parameters. The model comprises a set of difference equations. The model is implemented to analyze alternative response policies. It is shown that a mixture of mass and trace vaccination policies- the prioritized vaccination policy-is more effective than either of the two aforementioned policies.
DTIC
Smallpox; Immune Systems; Viruses

20030109374 Massachusetts Inst. of Tech., Cambridge, MA
Contribution of Bone Marrow-Derived Cells to the Tumor Stroma in Human Breast Cancer
Gupta, Piyush; Weinberg, Robert A.; Apr. 2003; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0468
Report No.(s): AD-A417609; No Copyright; Avail: CASI; A03, Hardcopy

Breast cancer is a disease whose progression requires the involvement of many different cell types. These cell types, in addition to the mutated cancerous cells that initiate formation of the tumor mass, include non-cancerous blood vessel and connective tissue cells. These ancillary cell types, while not cancerous on their own, are required by the cancer cells in order for a tumor to grow beyond a very small size. Therefore, it is important to understand the interactions between the cancerous and non-cancerous cellular components of a breast tumor mass, since such interactions nay serve as novel targets for therapeutic intervention. In addition to studying the nature of the interactions between the cancerous and non- cancerous cells, it is essential to know the origin of the non-cancerous cells in a tumor mass. It has been assumed that these supportive cell types derive from regions of tissue adjacent to the site of carcinogenesis. This work examines a second possibility that is plausible on the basis of recent literature; namely, that a significant fraction of the non-cancerous cells in a tumor mass can

derive from, in addition to adjacent tissue, the circulation of a tumor bearing animal.
DTIC
Cancer; Bone Marrow

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20030108671 Rutgers - The State Univ., New Brunswick, NJ
Biomarkers for Monitoring In-Situ Biodegradation of PAHs in Anoxic Harbor Sediment
Young, Lily Y.; Kerkhof, Lee J.; Phelps, C. D.; Sep. 2002; 6 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0083
Report No.(s): AD-A417302; No Copyright; Avail: CASI; A02, Hardcopy

Biomarkers for monitoring in situ biodegradation of PAHs in anoxic sediments were developed by careful study of microbial degradation mechanisms. Both metabolic and molecular - (genetic) biomarkers were studied. Several unique metabolites of anaerobic naphthalene - degradation were identified and methods were developed for detecting them in environmental samples. Detection of these metabolic biomarkers at several contaminated sites has demonstrated their usefulness. The other biomarker that was developed was the dsrAB gene. A comparison of many different sequences of this gene allowed us to identify sequence groups that are correlated to PAH and petroleum hydrocarbon degradation.
DTIC
Biodegradation; Sediments; Anoxia; Biomarkers

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20030108473 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD, USA
Test Results of Phase 3 Level B Suits to Challenge by Chemical and Biological Warfare Agents and Simulants: Summary Report
Lindsay, Robert S.; Procell, Suzanne A.; Baldauf, Frederick C.; Pappas, Alex G.; Jun. 2003; 42 pp.; In English
Report No.(s): AD-A417249; ECBC-TR-296; No Copyright; Avail: CASI; A03, Hardcopy

Swatches from three commercially available Level B protective suits were challenged with liquid droplets of Sarin (GB) and mustard (HD) using modifications of the static diffusion procedure described in TOP 8-2-501. The cumulative mass of each agent that permeated each swatch was determined over time, and the results for all swatches were used to determine a weighted-average cumulative mass for each suit. From these data, a physiologically-derived breakthrough time was calculated for each suit for the purposes of comparison. In addition, intact suits were challenged with corn-oil aerosol to simulate a biological or chemical aerosol. Protection factors were determined for each suit.
DTIC
Protective Clothing; Performance Tests; Biological Weapons; Chemical Warfare

20030109078 Naval Surface Warfare Center, Dahlgren, VA
Human-Systems Engineering: Understanding the Process of Engineering the Human into the System
Wallace, Daniel; Winters, John; Dugger, Melissa; Lackie, John; Hamburger, Trish; Nov. 2001; 73 pp.; In English
Report No.(s): AD-A417413; NSWCDD/TR-01/101; No Copyright; Avail: CASI; A04, Hardcopy

This report provides guidance on how human engineering practices can be better incorporated into systems engineering processes. The intended audience includes developers, engineers, and integrators who want to produce systems that will have greater capability through better consideration of all users. Four major impact areas for coordination of human engineering and systems engineering activities are discussed, and details of relevant interactions throughout the system development

process have been identified. Information is provided linking the different actions to steps in different documented systems engineering standards and processes.
DTIC
Human Factors Engineering; Systems Engineering

20030109088 Naval Postgraduate School, Monterey, CA
Continuous Biometric Authentication for Authorized Aircraft Personnel: A proposed Design
Carrillo, Cassandra M.; Jun. 2003; 113 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417373; No Copyright; Avail: CASI; A06, Hardcopy

Today, there is no way to ensure that the personnel working within the cockpit of an aircraft in flight are authorized to be there. The primary goal of this thesis is to propose a hypothetical design for the use of a non- intrusive mechanism on the flight deck of an aircraft to provide continuous or periodic authentication of authorized aircraft personnel. The mechanism should answer questions such as: 'Is the person who is flying the plane actually the person who they say they are?' and 'Is the correct person in control of the aircraft throughout the whole flight segment?' We will investigate biometrics as a possible security mechanism. In this thesis, various biometric methods are examined and their application in the flight deck is shown. Studies that have been conducted on real biometric devices are examined and their results are reported. Also examined are the current practices and procedures that take place in the flight deck, so that the proposed designs can be understood to not interfere with current activities therein. Two biometric solutions (i.e. proposed designs) to provide continuous or periodic authentication of authorized personnel in the flight deck are introduced. The proposed designs are general and can be used with different types of biometric device(s), and can be extended to include multi-biometrics.
DTIC
Cockpits; Biometrics; Personnel; Aircraft Control

20030109135 Naval Health Research Center, San Diego, CA
Assessment of Potential Radiation Hazard from the COMWIN Vest Antenna
Ziriax, John M.; Hurt, William; Cox, Duane; Marchello, Donald; D'Andrea, John; Oct. 2003; 59 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417576; NHRC-DET-DEBL-TR-2003-01; AFRL-HE-BR-TR-2003-0132; No Copyright; Avail: CASI; A04, Hardcopy

The COMbat Wear integration (COMWIN) antenna is currently being developed by Dr. Richard Adams of SPAWAR Systems Center, San Diego. The antenna would replace the whip antenna on man portable radios with a vest partially composed of a conductive fabric. The vest would make it more difficult for adversaries to locate and identify radio operators and would not interfere with operator's movement in the way protruding antenna would. These advantages result because of the close proximity of the antenna to the body of the operator. This report describes the results of an assessment of the radio frequency energy deposited in the body of the operator wearing three versions of the Mark III COMWIN vest antenna. A human phantom was used for the measurements because probes must be inserted within the body. Local specific absorption rates (SARs) were measured in the homogeneous tissue equivalent phantom using non-perturbing temperature probes at frequencies ranging from 30 to 450 MHz. In addition, local and whole body SARs were calculated using the Brooks anatomical man model. The results of the empirical measurements and the theoretical modeling suggest that, given a net input power to the antenna of 5W, the energy absorbed by the operator would not exceed current safety standards even if the operator were to transmit continuously. Under normal operation, when transmission is interrupted, the duty cycle of the antenna and the resulting SAR will be substantially lower.
DTIC
Radiation Hazards; Combat; Whip Antennas; Radio Frequencies

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20030109093 Massachusetts Inst. of Tech., Cambridge, MA
Spike-Based Hybrid Computers
Sarpeshkar, Rahul; Oct. 2, 2003; 6 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0244
Report No.(s): AD-A417467; No Copyright; Avail: CASI; A02, Hardcopy

This report documents progress made during the period July 1st 2002 to Jan 2003 for the ONR grant 'Spike- Based Hybrid Computers'. It is the fourth and final progress report for this grant. Our progress this year was in three areas: (1) Ultra-Low-Power Time-Based Analog-to-Digital Conversion inspired by neuronal signal representations; (2) An analog integrated circuit memory element for use in learning and adaptive systems, and (3) A predictive comparator with adaptive control that exploits knowledge of the signal to predict it and thus save energy.
DTIC
Hybrid Computers; Adaptive Control; Comparators; Computer Storage Devices

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20030108431 Bowie State Univ., MD
Building the DAML Electronic Commerce Domain
Anyiwo, David E.; Jul. 29, 2002; 32 pp.; In English
Contract(s)/Grant(s): MDA972-01-C-0050; ARPA ORDER-L270
Report No.(s): AD-A417127; FTR-05; No Copyright; Avail: CASI; A03, Hardcopy

The inability of the Web applications built on the prevalent hypertext markup language (HTML) infrastructure to meaningfully share information has greatly hindered electronic commerce. These applications do not adequately analyze and semantically structure the overwhelming amounts of data returned to a user through a keyword, full-text, or other search. The inadequacy of the existing Web tools to semantically structure information has caused staggering costs and productivity losses in the business-to-business (B2B) electronic commerce domain. Agent technology provides an efficient approach to achieving interoperabilty of Web applications and offers a framework for developing Semantic Web tools that enable seamless electronic commerce. This project has built a B2B eCommerce Gateway (DAMLGate) on the DARPA agent markup language (DAML) infrastructure. DAMLGate enables interoperability and linking of Web documents to machine-readable ontologies. The initial version of DAMLGate facilitates distributed agile manufacturing processes in the highly automated and dynamic electronics assembly environment.
DTIC
Electronic Commerce; Computer Programming; Information Retrieval

20030108432 Bowie State Univ., MD
Building the DAML Electronic Commerce Domain
Anyiwo, David E.; Feb. 15, 2002; 5 pp.; In English
Contract(s)/Grant(s): MDA972-01-C-0050; ARPA ORDER-L270
Report No.(s): AD-A417128; No Copyright; Avail: CASI; A01, Hardcopy

This reporting period was quite busy. We made progress in ontology design, and established the project Web page. To demonstrate our e-portal design, we deployed the DAML eCommerce Gateway (DAMLGate) prototype on a private server that also temporarily hosted our Web page.
DTIC
Electronic Commerce; Computer Programming; Document Markup Languages

20030108433 Bowie State Univ., MD
Building the DAML Electronic Commerce Domain
Anyiwo, David E.; Nov. 15, 2001; 5 pp.; In English
Contract(s)/Grant(s): MDA972-01-C-0050; ARPA ORDER-L270
Report No.(s): AD-A417129; No Copyright; Avail: CASI; A01, Hardcopy

The project captured additional functional and technical requirements for collaboration and exchange in the electronics industry's value chain, and refined the eCommerce domain ontology requirements identified in the previous quarter. The effort this quarter focused on analyzing e- business models and the development of a strategic framework for planning the implementation of an integrated 'collaborative' model. A major strategic business assumption underlying the modeling process is that worldwide B2B e- commerce will continue to grow at aggressive rates through 2003, when e-business becomes the predominant means of marketing in many industries, causing a massive upswing in 2004 and driving fundamental changes to

the way enterprises do business with each other. Also, it is assumed that e- marketplaces will drive nearly 40 percent of B2B e-commerce transactions in 2004. The probability of occurrence of the market outcomes predicted above is estimated at about 20 percent.
DTIC
Electronic Commerce; Functional Design Specifications; Management Planning; Document Markup Languages; Computer Programming

20030108434 Bowie State Univ., MD
Building the DAML Electronic Commerce Domain
Anyiwo, David E.; Aug. 15, 2001; 5 pp.; In English
Contract(s)/Grant(s): MDA972-01-C-0050; ARPA ORDER-L270
Report No.(s): AD-A417130; No Copyright; Avail: CASI; A01, Hardcopy

The DAML Electronic Commerce Domain project was officially launched at the kick-off meeting of the project team held at Bowie State University (BSU), Bowie, Maryland on May 15, 2001. The goal of this project is to build a DAML-driven infrastructure for business-to-business (B2B) and other electronic commerce. The thrust of the current effort is to provide a Web-based, open participation environment that offers opportunities for productivity enhancement and quality improvement in the electronics and related industry group value chains. The project is developing a framework for a DAML-driven electronic commerce gateway (the DAML eGateway) that delivers e-portal services in the B2B e-market. This document presents the first quarterly report of the project effort. The report describes the progress the project has made in the period from May 15 to August 15, 2001.
DTIC
*Electronic Commerce; Computer Programming*DTIC

20030108654 Naval Postgraduate School, Monterey, CA
Evaluation of Potential DSS Tool for BDF HQ Manpower and Operational Equipment Resource Planning
Alhamdan, Ali M.; Jun. 2003; 133 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417321; No Copyright; Avail: CASI; A07, Hardcopy

This thesis explores the Bahrain Defense Force (BDF) needs for a decision support system in the area of analyzing, establishing and maintaining the organizational structures of BDF units, It also identifies the BDF measures that must be taken to qualify a certain unit structure, Subsequently, the thesis designs and develops a specific DSS prototype that can aid BDF decision makers and planners perspectives in this area, Creating this prototype has involved three different layers to be investigated: the data, the models and the user interfaces, The data layer consists of a Microsoft Access (TM) database application that houses BDF Units, Manpower, Vehicles, Weapons, Salaries, and Jobs information, The model layer consists of two Microsoft Excel (TM) spreadsheets that contain Infantry Battalion and enhanced Armor Battalion HR optimization models, The Ul layer consists of user controls, input/output forms, queries, reports, and visualization aids (i,e, charts and pivot tables), These interfaces were developed using MS Access capabilities, Consequently, the BDF_DSS is an integration of database and optimization technology using widely available desktop tools, The general benefits of this DSS are reduced costs for data gathering, computation, and data presentation, and added value resulting from investigating more alternatives, doing more sophisticated analyses of alternatives, using better methods of comparing alternatives, and making quicker and better decisions.
DTIC
Data Bases; Decision Support Systems; Evaluation; Architecture (Computers); Operational Problems

20030108670
Simulation of the Optical Properties of Atmospheric Aerosols in the Planetary Boundary Layer (BPL)
Saija, Rosalba; Sep. 2002; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N68171-01-M-5907
Report No.(s): AD-A417113; ERO-9199-EN-01; No Copyright; Avail: CASI; A03, Hardcopy

We report in this paper the relevant results obtained for the calculation and the retrieving of the optical properties of the particles that can constitute the atmospheric aerosols. In the first section we present the preliminary results of computations of the optical properties (extinction and backscattering) for low density dispersions of particles with an irregular shape. These particles are modelled as clusters of spheres and the calculated Lidar ratios will be compared with the other computations performed using spheres with Mie theory. The values of the lidar ratio will also constitute the data base for the interpretation

of the experimental data obtained with LIDAR systems. In the second section we implemented a neural network that proved to be a useful tool for the recognition of the microphysical properties of a low density dispersion of spherical particles from the angular pattern. In future we plan to extend the algorithm to the recognition of the optical parameters for nonspherical particles. In the third section we have explored the scattering properties of the irregular shaped aerosols by means an angular analysis in the IR-VIS range aimed to compare the calculated scattering patterns with the experimental ones obtained with a two-dimensional angular optical scattering device (TAOS). More extended comments are contained in a paper that will be published in Applied Optics.
DTIC
Planetary Boundary Layer; Planetary Atmospheres; Computerized Simulation; Aerosols; Optical Properties

20030108677 Naval Postgraduate School, Monterey, CA
Usability Analysis of the Channel Application Programming Interface
Brown, Christopher A.; Jun. 2003; 147 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417334; No Copyright; Avail: CASI; A07, Hardcopy

The Channel Application Programming Interface (API) provides a tool for loosely coupling components in Component Based Design (CBD) projects In the thesis that proposed and developed the API, the author provided a technical analysis of the API's performance with respect to communication metrics However, only the author/designer has ever used the API; hence, no analysis was accomplished with respect to usability attributes, The project sponsor desires public release of the API, especially within the Department of Defense (DoD) however, a usability analysis is first required to ensure wide acceptance and use of the API, In order to analyze the API, an analysis method and associated metrics are required, Little work has been done in the field of Human Computer Interface (HCI) with respect to treating an API as an interface and programmers as the end users, This thesis follows an IEEE published case-study and well known HCI usability analysis methods to test the API for general usability attributes as well as to investigate specific features of the API, Specifically, the analysis will test the API's ability to explain its functionality during first time exposure, The API's acceptance will depend on its success or failure to convey its purpose quickly during this initial exposure, The results from testing the API are used to determine required enhancements to the API and its documentation.
DTIC
Computer Programming; Application Programming Interface; Defense Program; Human-Computer Interface

20030108716 Texas A&M Univ., College Station, TX, USA
Dual Rotor-High Fidelity Bearing-Blade Out Simulation Code GUI
Ganesan, Karthik; Subrmaniyam, Lakshmi; Smart Structural Components and Simulation Tools for Increased Engine Efficiency, Flight Range, and Safety; April 2003, pp. 191-213; In English; See also 20030108713; No Copyright; Avail: CASI; A03, Hardcopy

MATLAB GUI has been developed for user friendly operation of a version of code in B.3. Advanced, 3D high fidelity ball bearing model has been developed with independent ball motions and non-linear force deflection capability. This report presents a step by step example of the GUI.
Derived from text
Ball Bearings; Graphical User Interface

20030108718 Texas A&M Univ., College Station, TX, USA
GUI For Two-Dimensional Isolated Ball Bearing Code
Ganesan, Karthik; Subramaniyam, Lakshmi; Smart Structural Components and Simulation Tools for Increased Engine Efficiency, Flight Range, and Safety; April 2003, pp. 97-111; In English; See also 20030108713; No Copyright; Avail: CASI; A03, Hardcopy

A code was developed for predicting stiffness and power losddrag torque for isolated bearings. This document presents the MATLAB Graphical User Interface (GUI) developed for user friendly operation of code in B.l
Derived from text
Ball Bearings; Graphical User Interface; Stiffness

20030108719 Texas A&M Univ., College Station, TX, USA
Dual Rotor-High Fidelity Bearing-Blade Out Simulation Code (DRBB)
Nikhil, Kaushik; Sun, Guangyoung; Palazzolo, Alan; Smart Structural Components and Simulation Tools for Increased Engine Efficiency, Flight Range, and Safety; April 2003, pp. 112-190; In English; See also 20030108713; No Copyright; Avail: CASI; A05, Hardcopy

Described is a Dual Rotor Blade Loss Simulation Code developed to integrate high fidelity ball bearing squeeze film damper model into rotor code. Modelling capabilities will be enhanced to include 3D nonlinear ball bearing model, more rotor and stator levels and more finite element types. Code predicts bearing temperatures and stresses and squeeze damper pressures along with shaft vibration.
Derived from text
Ball Bearings; Computer Programs; Turbine Blades

20030108720 Texas A&M Univ., College Station, TX, USA
Three-Dimensional High Fidelity Ball Bearing Simulation Code
Sun, Guangyoung; Palazzolo, Alan B.; Smart Structural Components and Simulation Tools for Increased Engine Efficiency, Flight Range, and Safety; April 2003, pp. 214-280; In English; See also 20030108713; Original contains black and white illustrations; No Copyright; Avail: CASI; A04, Hardcopy

MATLAB GUI has been developed for user friendly operation of a version of code in B.3. An advanced, 3D high fidelity ball bearing model has been developed with independent ball motions and non-linear force deflection capability.The simulation code is developed to predict the contact force and stress applied for individual balls, and thermal loads in bearing in the presence of high unbalance force.
Derived from text
Ball Bearings; Computerized Simulation; Loads (Forces)

20030108771 Grammatech, Inc., Ithaca, NY
Dependence Graphs for Information Assurance of Systems
Teitelbaum, Ray; Jun. 2003; 72 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-C-0080; Proj-IAST; DARPA Order J778
Report No.(s): AD-A417480; AFRL-IF-RS-TR-2003-143; No Copyright; Avail: CASI; A04, Hardcopy

Although information flows are critical for understanding assurance and survivability of systems and system designs, tools for understanding information flows in systems are poor. This project sought to provide better tools by exploiting recent advances in tools for understanding information flows in sequential programs using dependence analysis, which provides a sound basis for understanding such information flows. The goal was to develop SystemSurfer, a tool for the information-flow properties of UML designs, and the Information Assurance Workbench, a system for finding assurance problems in programs. These systems were to be based on CodeSurfer, our program-understanding tool. The application of these techniques to UML designs required the design of extensions to the dependence analysis to support concurrency and asynchronous transfer of control. To improve accuracy, it was necessary to consider using abstract interpretation. This project was terminated early because of the cancellation of the IASET project, but not before achieving results in the area of dependence-graph representations, and queries for software assurance. The results of the research are described in the appendices.
DTIC
Computer Programs; Information Flow; Information Systems; Flow Characteristics

20030108778 Military Academy, West Point, NY
Modeling of HEL Weapons in Combat Simulations
DeLong, Suzanne O.; Tollefson, Eric S.; Burk, Roger C.; Sep. 2003; 28 pp.; In English
Report No.(s): AD-A416997; DSE-TR-03-02; No Copyright; Avail: CASI; A03, Hardcopy

As part of the Joint Technology Office (JTO) High Energy Laser (HEL) modeling and Simulation (M&S) study, we conducted an inventory and evaluated existing HEL M&S capabilities of Army combat M&S software packages to judge their applicability, utility, and limitations with respect to modeling HEL weapons. Based on that survey and the unique Army requirements for modeling HEL weapons in ground warfare and air and missile defense scenarios, we narrowed our focus to a few of the existing models. On those models, we conducted a software study to determine the issues, implications, and limitations of integrating HEL weapons into the selected software packages. We conclude with a refined roadmap for future research in this area.
DTIC
High Power Lasers; Computerized Simulation; Mathematical Models; Laser Weapons; Combat

20030108779 Air Force Research Lab., Brooks AFB, TX

Large-Scale Laboratory Test of Occupational Survey Software and Scaling Procedures

Albert, Walter G.; Phalen, William J.; Selander, David M.; Dittmar, Martin J.; Rouse, Ian F.; Sep. 2002; 9 pp.; In English

Contract(s)/Grant(s): F33615-91-D-0010; Proj-1123

Report No.(s): AD-A417281; AFRL-HE-AZ-TP-2002-0006; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes a research and development effort to automate and improve data collection associated with USAF occupational surveys. Specifically the effort involves: (a) research and development of a PC-based procedure for self-administration of occupational surveys as a replacement for the existing paper-and-pencil process, (b) research and development of automated scaling procedures of optimal validity and reliability for obtaining measures of time spent on job-related tasks, (c) incorporation of feedback and branching techniques into the automated survey technology that will permit administration of large and complex occupational surveys, and (d) development of implementation guidelines for use in base-level computer systems and AF-wide electronic data transmission networks.

DTIC

Reliability; Software Engineering; Data Transmission

20030108780 Defence Science and Technology Organisation, Salisbury, Australia

State-Machine Modelling in the DOVE System

Can, A.; Eastaughffe, K.; Liu, C.; Mahoney, B.; McCarthy, J.; Feb. 2003; 67 pp.; In English

Report No.(s): AD-A417282; DSTO-RR-0255; DODA-AR-012-783; No Copyright; Avail: CASI; A04, Hardcopy

The DOVE tool supports high-level system modelling and design, and formal reasoning about critical properties. DOVE uses state-machine graphs to illustrate designs, thus building on a familiar and effective means of communicating system designs to a wide audience. DOVE employs a propositional temporal logic to express desirable behavioural properties of the design, and presents it in a sequent calculus syntax for ease of manipulation. A verification procedure which can handle temporal properties of DOVE state machines is included through high level tactics in a graphical proof tool interface. The DOVE program is committed to developing proof visualization techniques to complement the power of this proof scheme. This paper presents the theoretical structure underlying the DOVE tool.

DTIC

Software Development Tools; Mathematical Logic

20030108784 Naval Research Lab., Stennis Space Center, MS

New Developments in Internet-Based Delivery of MetOc Data to Warfighters

Warner, Elizabeth; Ladner, Roy; Katikaneni, Udaykiran; Shea, John J.; Jan. 2003; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A417528; NRL/PP/7440--03-1017; No Copyright; Avail: CASI; A02, Hardcopy

Access and retrieval of meteorological and oceanographic data from heterogeneous sources in a distributed system presents many issues. Effective bandwidth utilization is important for any distributed system. In addition, specific issues need to be addressed in order to assimilate spatio- temporal data from multiple sources. These issues include resolution of differences in datum, map-projection and time coordinate. Reduction in the complexity of data formats is a significant factor for fostering interoperability. Simplification of training is important to promote usage of the distributed system. Here, we describe particular techniques that revolutionize the Internet-based delivery of MetOc data to address the needs of the Warfighter.

DTIC

Information Retrieval; Computer Programs; Data Bases; Meteorological Parameters; Oceanographic Parameters

20030108787 Naval Research Lab., Stennis Space Center, MS

Geophysical Data Base Variable Resolution (GDBV): An Object-Oriented Database for Dynamic Geo-Acoustic Data Storage

Steed, Chad A.; Harvey, David W.; Koehler, Kim A.; Northridge, Bruce; Jan. 2003; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A417531; NRL/PP/7440--03-1001; No Copyright; Avail: CASI; A02, Hardcopy

The Geophysical Data Base-Variable resolution (GDBV) is a modem, object-oriented database product that is designed to accommodate the dynamically derived parameters of the Geo-Acoustic Inversion Techniques (GAIT). Sponsored by the Oceanographer of the Navy (CNO N096) via PEO(C4I and Space) PMW-155, GAIT/ GDBV is a Through-the-Sensors (TTS)

program that includes a flexible data model for the assimilation of data at local, regional, and global levels of operation. In addition to its dynamic capabilities, GDBV also includes support for historical database roles similar to the Naval Oceanographic Office's (NAVOCEANO) Low Frequency Bottom Loss (LFBL) database. In order to demonstrate its highly extendable design, this paper explores GDBV's database format and data model. In both the historical and dynamic capacity, GDBV must be capable of evolving with new system specifications. GDBV's multiple levels of organization and object-oriented implementation provide an efficient solution to these requirements. In addition its dynamic operational requirements, the GDBV database will accommodate the parameters from each of the following OAML databases produced by NAVOCEANO: High Frequency Bottom Loss (HFBL), LFBL, Mine Ware (MIW) Surface Sediments, and LFBL's N-Layer portion (GDB). Support for these static databases will facilitate the absorption of each individual database into a single broad database that provides a complete description of the ocean bottom, OAML GDBV. The complete parameter set of GDBV is presented along with a physical representation of the parameters. The concept of operation for GDBV in TEDServices is presented for local, regional, and global levels of operation. The overall data flow is very similar to a preceding Through-The-Sensors (TTS) database system, PUMA-TEDS. This working example of GDBV in GAIT/ TEDServices reinforces the portability of the database design and the benefits of generation.
DTIC
Data Bases; Geophysics; Object-Oriented Programming; Acoustics; Oceanographic Parameters

20030108816 Naval Postgraduate School, Monterey, CA
Holistic Framework For Establishing Interoperability of Heterogeneous Software Development Tools
Puett, Joseph F., III; Jun. 2003; 370 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417541; No Copyright; Avail: CASI; A16, Hardcopy

This dissertation presents a Holistic Framework for Software Engineering (HFSE) that establishes collaborative mechanisms by which existing heterogeneous software development tools and models will interoperate. Past research has been conducted with the aim of developing or improving individual aspects of software development; however, this research focuses on establishing a holistic approach over the entire development effort where unrealized synergies and dependencies between all of the tools' artifacts can be visualized and leveraged to produce both improvements in process and product. The HFSE is both a conceptual framework and a software engineering process model (with tool support) where the dependencies between software development artifacts are identified, quantified, tracked, and deployed throughout all artifacts via middleware. Central to the approach is the integration of Quality Function Deployment (QFD) into the Relational Hypergraph (RH) Model of Software Evolution. This integration allows for the dependencies between artifacts to be automatically tracked throughout the hypergraph representation of the development effort, thus assisting the software engineer to isolate subgraphs as needed.
DTIC
Software Engineering; Software Development Tools; Heterogeneity

20030108967 Army Engineer Research and Development Center, Vicksburg, MS, USA
Design by Analysis of Innovative Navigation Structures. Theoretical Manual
Slattery, Kerry T.; Riveros, Guillermo A.; Aug. 2003; 57 pp.; In English
Report No.(s): AD-A417431; ERDC/ITL-TR-03-4; No Copyright; Avail: CASI; A04, Hardcopy

This report describes the development of design by analysis methods for innovative navigation structures. The modeling approach is designed to facilitate the development of a complex three-dimensional finite element mesh and efficiently analyze the structure. Techniques to automatically generate a detailed model of the structure and perform required analysis and design calculations for the individual concrete slabs under all applied loads are illustrated, along with methods for identifying and reporting details of the design for each slab under the worst-case loading. The two-way slab design approach (based on American Concrete Institute guidance, ACI 318-02) is summarized, along with a description of methods to calculate shear, moment, and thrust throughout the shell elements and at selected cross sections of the superelements. The design section includes the approach used to modify design parameters based on analysis results. Finally, guidelines are provided for modeling the response of soil and piles used in the foundation.
DTIC
Computer Programs; Computer Aided Design; Design Analysis; Navigation; User Manuals (Computer Programs)

20030109055 Naval Research Lab., Stennis Space Center, MS

Parallel Software Solutions for Processing Hydrographic Data

Miller, M. J.; Layne, Geary; Braud, James E.; Sarnowski, Krzysztof; Jan. 2002; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A417643; NRL/PP/7740--03-1020; No Copyright; Avail: CASI; A02, Hardcopy

The research in this paper focuses on the I/O problem associated with a parallel application writing to a single physical disk. Included in our research are the original ideas that led to the first version of the parallel software, subsequent versions of the software derived from lessons learned from benchmark results, and speedup results of each version. The underlying purpose of this software is to process hydrographic data having a complicated, multi-tiered format. The data processing involves reading tens to hundreds of files containing raw data, filtering out extraneous data values, and writing the filtered data to a single file used in additional processing. The problem is not computationally intensive, but bound by the system's file writing capability. Results show that the more responsible the software was for organizing the data before writing, the better the speedup. The critical factor for writing data efficiently involved the limitation of writing data over a single I/O controller. Our parallel software has fantastic utility where system specifications do not allow for the use of parallel file systems, or writing data over multiple I/O controllers.

DTIC

Data Processing; Parallel Processing (Computers); Computer Programs; Hydrography; Data Transfer (Computers)

20030109067 Army Engineer Research and Development Center, Vicksburg, MS, USA

Design by Analysis of Innovative Navigation Structures: User Manual

Slattery, Kerry T.; Riveros, Guillermo A.; Aug. 2003; 143 pp.; In English

Report No.(s): AD-A417396; ERDC/ITL-TR-03-5; No Copyright; Avail: CASI; A07, Hardcopy

This report is the user manual for the 'Design by Analysis System-Innovative Navigation Structures' (DBAS-INS). The Windows-based computer program creates a solid, three- dimensional (3D) finite element model of innovative structures fabricated using 'in-the-wet' construction methods, such as the Braddock Dam currently under construction in the U.S. Army Corps of Engineers' Pittsburgh District. These structures are initially fabricated as a floating shell in a dry dock. The floating shell is divided into a 2D grid of hollow cells separated by reinforced concrete walls. Most significant structural loads involve hydrostatic pressures on the walls as the segment is floated to the installation site, lowered to the foundation, and filled with tremie concrete. The individual concrete slabs that form the walls of the cells must be designed for shear, moment, and thrust loads caused by the expected load combinations on the structure. DBAS-INS procedures were developed to assist in the design and analysis of innovative navigation structures by simplifying the steps required to describe a new design, create a finite element model, check all load cases, design the reinforced concrete structure, and study modifications to the design. The DBAS-INS program allows the designer to create an accurate finite element model for a complex, 3D structure and to complete a preliminary layout and design in a fraction of the time normally required. After analysis, the program checks design requirements per ACI 318-02 (American Concrete Institute 'Building Code Requirements for Structural Concrete') and, based on these results, can automatically modify the design and reanalyze the model.

DTIC

Computer Programs; Computer Aided Design

20030109071 Kent State Univ., OH

Scalable Stream Coding for Adaptive Foveation Enhanced Percept Multimedia Information Communication for Interactive Medical Applications

Khan, Javed I.; Jun. 2003; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-99-1-0515; Proj-H491

Report No.(s): AD-A417645; AFRL-IF-RS-TR-2003-174; No Copyright; Avail: CASI; A03, Hardcopy

Project Perceptmedia is one of the few projects within the Active Network Initiative (ANI) to conduct a top down investigation into active networking from the point of view of realistically complex high performance applications. The project developed a suit of futuristic active applications based on the core idea of media transcoding. It then closely examined the issues if such complex active services were to run from network embedded router centric computing platforms contemplated in ANI. The demonstrated systems include interactive perceptual transcoding where real-time eye-tracker data fuses with a passing stream, the active subnet diffusion coding-- where multiple active nodes dynamically and adaptively aggregate to tackle intense tasks, and the active video content filtering and analysis. The research produced several novel algorithmic contributions to the field including the first algorithms for active computing mapping, jitter and delay reduction in active

computing, and an IPV6 based novel mechanism for fast traffic interception. The project produced proof of concept implementations for almost all of these ideas.
DTIC
Multimedia; Real Time Operation; Computer Networks; Architecture (Computers)

20030109099 Naval Postgraduate School, Monterey, CA
Contextual Criticality of Knowledge-Flow Dynamics: The Tragedy of Friendly Fire
Nissen, Mark E.; Jansen, Erik; Jones, Carl; Thomas, Gail; Sep. 30, 2003; 33 pp.; In English
Report No.(s): AD-A417483; NPS-GSBPP-03-002; No Copyright; Avail: CASI; A03, Hardcopy

Recent research has produced models that improve our ability to identify, describe and explain a diversity of knowledge-flow patterns that manifest themselves in various enterprises, which improves our efficacy in designing organizations and processes. But enterprises do not all operate in the same environmental context and current theory is relatively silent on contextual implications of knowledge flow. The research described in this technical report builds upon current theory to explicitly address the contextual implications of knowledge flow in terms of organization and process design. Using a recently developed, multidimensional model to characterize and delineate a variety of enterprise knowledge flows, we integrate key aspects of Coordination Theory and extend this model to address context. The use, utility and implications of this extended model are described through application to an extreme case in which knowledge flows are embedded within a hazardous, time-critical context with mortal consequences: a military 'friendly fire' incident in Northern Iraq. The extreme nature of this application case provides revelatory insight into the contextual importance of knowledge-flow dynamics, and by using such an extreme case for application, we enhance the generalizability of our model to less extreme environments that are more commonly associated with non- military enterprises (e.g., corporations, governmental agencies).
DTIC
Fluid Dynamics; Flow Distribution

20030109102 Massachusetts Univ., Amherst, MA
Enhancing Survivability with Distributed Adaptive Coordination
Lesser, Victor; Jun. 2003; 52 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-1-0249; Proj-F160; DARPA Order F160
Report No.(s): AD-A417471; AFRL-IF-RS-TR-2003-142; No Copyright; Avail: CASI; A04, Hardcopy

The focus of this effort was to develop distributed detection and diagnosis algorithms for use in recognizing and explaining the cause of unacceptable performance of a distributed, multi-agent system. The explanation generated by the diagnosis algorithms was to be used by other components of the agent to reorganize processing in order to improve performance given current capabilities and resources. In this way, the system would have a higher degree of survivability in the event of software errors, hardware malfunctions, or hostile attacks. The researchers view survivable systems as computational organizations that can redesign themselves in response to threats and opportunities. A central assumption of organizational design is that there exist alternative ways to accomplish tasks in terms of agents, methods and resources used. In systems of any complexity, such alternatives do exist, and systems constructed for survivability will intentionally contain them. Under these conditions, the central challenges of survivability are making effective use of the available alternatives, acquiring knowledge about those alternatives, and making inferences based on that knowledge.
DTIC
Computer Programs; Detection; Malfunctions

20030109103 Rice Univ., Houston, TX
Code Optimization for Embedded Systems
Cooper, Keith D.; Subramanian, Devika; Torczon, Linda; Jun. 2003; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-2-0298; Proj-D002; DARPA Order F297
Report No.(s): AD-A417472; AFRL-IF-RS-TR-2003-145; No Copyright; Avail: CASI; A03, Hardcopy

This project investigated a number of problems that arise in compiling application code for embedded systems. These systems present the compiler with a number of challenges that arise from economic constraints, physical constraints, and idiosyncratic requirements of the application and processors. The project developed new techniques in optimization and code generation that addressed problems including code size reduction, instruction scheduling, data placement (on partitioned

register set machines), spill code reduction, and operator strength reduction. It also produced fundamental work on transformation ordering.
DTIC
Compilers; Economics

20030109105 Rochester Univ., NY
Agent Based Architectures for Dynamic Crisis Management
Allen, James; Ferguson, George; Jun. 2003; 67 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-98-2-0133; DARPA ORDER-J387; Proj-AGEN
Report No.(s): AD-A417473; AFRL-IF-RS-TR-2003-146; No Copyright; Avail: CASI; A04, Hardcopy

The focus of this research was on how human users can connect to, participate in, and control agent-based systems. One of the primary accomplishments was the development of a collaborative, dialogue-based problem solving model. The approach incorporates mixed-initiative, dialogue and agent-based technologies. The model was built in a fashion where the human works with an automated intelligent assistant agent that coordinates the interaction with other agents. The model provides a framework for interpreting the user's intentions in the interaction. A dialogue-based system approach proved to be an effective way to support humans when managing agents. Such an approach facilitates intuitive and natural human-computer interaction. The underlying problem solving model supports domain-independent collaboration with a human user. The system was built off of a previously successful dialogue-based mixed-initiative planning system called TRIPS (The Rochester Interactive Planning System). This report discusses the architecture and infrastructure for the system developed. Detail is provided on the model of collaborative problem solving. A number of experiments involving integrated, end-to-end human in the loop agent-based systems are also discussed.
DTIC
Human-Computer Interface; Coordinates; Planning

20030109107 Naval Postgraduate School, Monterey, CA
A Framework For Dynamic Subversion
Rogers, David T.; Jun. 2003; 128 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417568; No Copyright; Avail: CASI; A07, Hardcopy

The subversion technique of attacking an operating system is often overlooked in information security. Operating Systems are vulnerable throughout their lifecycle in that small artifices can be inserted into an operating system's code that, on command, can completely disable its security mechanisms. To illustrate that this threat is viable, it is shown that it is not difficult for an attacker to implement the framework for the 'two-card loader' type of subversion, a trap door which enables the insertion of arbitrary code into the operating system while the system is deployed and running. This framework provides several services such as memory allocation in the attacked system, and mechanisms for relocating, linking and loading the inserted attack code. Additionally, this thesis shows how Windows XP embedded designers can use Intel's x86 hardware more effectively to build a higher assurance operating system. Principles of hardware support are discussed and recommendations are presented. Subversion is overlooked because critics believe the attack is too difficult to carry out. It is illustrated in this thesis that this is simply not the case. Anyone with access to the operating system code at some point in its lifecycle can design a fairly elaborate subversion artifice with modest effort.
DTIC
Data Processing; Deployment; Operating Systems (Computers); Security

20030109108
Tracking of Multiple Maneuvering Targets in Clutter Using Multiple Sensors, IMM and JPDA Coupled Filtering
Tugnait, Jitendra K.; Jun. 2003; 17 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0971
Report No.(s): AD-A417569; No Copyright; Avail: CASI; A03, Hardcopy

We consider the problem of tracking multiple maneuvering targets in clutter using switching multiple target motion models. A novel suboptimal filtering algorithm is developed by applying the basic interacting multiple model (IMM) approach, the joint probabilistic data association (JPDA) technique and coupled target state estimation to a Markovian switching system. The algorithm is illustrated via a simulation example involving tracking of two highly maneuvering, at times closely spaced, targets.
DTIC
Algorithms; Maneuvers

20030109114 Naval Postgraduate School, Monterey, CA

An XML-Based Mission Command Language for Autonomous Underwater Vehicles (AUVs)

Hawkins, Darrin L.; Van Leuvan, Barbara C.; Jun. 2003; 132 pp.; In English; Original contains color illustrations

Report No.(s): AD-A417509; No Copyright; Avail: CASI; A07, Hardcopy

Autonomous Underwater Vehicles (AUVs) are now being introduced into the fleet to improve Mine Warfare capabilities. Several AUVs are under government-contracted development. Mission planning and data reporting vary between vehicles and systems. This variation does not pose an immediate problem, as only one AUV is typically in operation at any given time. However, as more AUVs are put into production, cooperative operations will become possible and consistent mission commands will be necessary for multiple AUVs. Without a single mission command language, multiple systems will require multiple languages. Extensible Markup Language (XML) and related technologies may be used to facilitate interoperability between dissimilar AUVs and extract and integrate mission data into Navy C41 systems. XML makes archive maintenance easier, XML documents can be accessed via an http server, and, in root form XML is transferable on the fly by style sheet. This thesis presents an XML-based mission command for the command and control of AUVs. In addition, this thesis discusses XML technology and how XML is a viable means of achieving interoperability. Furthermore, this thesis provides an example mission file using existing software, and demonstrates the future of XML in AUV technology. Finally, this work provides demonstration scripts and compelling arguments for the use of an XML-based mission command language to command all AUVs.

DTIC

Document Markup Languages; Interoperability; Mission Planning; Command Languages; Command and Control

20030109138 Naval Postgraduate School, Monterey, CA

Evaluating Configuration Management Tools For High Assurance Software Development Projects

Ziegenhagen, Lynzi; Jun. 2003; 107 pp.; In English

Report No.(s): AD-A417577; No Copyright; Avail: CASI; A06, Hardcopy

This thesis establishes a framework for evaluating automated configuration management tools for use in high assurance software development projects and uses the framework to evaluate eight tools. The evaluation framework identifies a dozen feature areas that affect a high assurance project team's ability to achieve its configuration management goals and evaluates the different methods that existing tools use to implement each feature area. Each implementation method is assigned a risk rating that approximates the relative risk that the method adds to the overall configuration management process. The tools with the lowest total ratings minimize risk to high assurance projects. The results of the evaluation show that although certain tools are less risky to use than other tools for high assurance projects, no tool minimizes risk in all feature areas. Furthermore, none of the existing tools are designed to leverage high assurance environments--i.e. none run on operating systems that have themselves been evaluated as meeting high assurance requirements. Thus, high assurance development projects that want to leverage the benefits of configuration management tools and achieve a sufficiently strong configuration management solution must employ existing tools in a protected environment that specifically addresses the risks created by the tools' implementation methods.

DTIC

Configuration Management; Software Engineering; Automatic Control

20030109143 Auburn Univ., AL, USA

Tracking of Multiple Maneuvering Targets Using Multiscan JPDA and IMM filtering

Puranik, Sumedh; Tugnait, Jitendra K.; Sep. 12, 2003; 22 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0971

Report No.(s): AD-A417567; No Copyright; Avail: CASI; A03, Hardcopy

The problem of tracking multiple maneuvering targets in the presence of clutter using switching multiple target motion models is considered. A novel suboptimal filtering algorithm is developed by applying the basic interacting multiple model (IMM) approach and joint probability data association technique. But unlike the standard single scan joint probabilistic data association (JPDA) approach, we exploit a multiscan joint probabilistic data association (Mscan-JPDA) approach to solve the data association problem. The algorithm is illustrated via a simulation example involving training of three maneuvering targets and a multiscan data window of length two.

DTIC

Algorithms; Target Acquisition; Tracking (Position)

20030109144 Naval Postgraduate School, Monterey, CA

Evaluation of Program Specification and Verification Systems

Ubhayakar, Sonali; Jun. 2003; 159 pp.; In English; Original contains color illustrations

Report No.(s): AD-A417580; No Copyright; Avail: CASI; A08, Hardcopy

Computer systems that earn a high degree of trust must be backed by rigorous verification methods. A verification system is an interactive environment for writing formal specifications and checking formal proofs. Verification systems allow large complicated proofs to be managed and checked interactively. We desire evaluation criteria that provide a means of finding which verification system is suitable for a specific research environment and what needs of a particular project the tool satisfies, Therefore, the purpose of this thesis is to develop a methodology and set of evaluation criteria to evaluate verification systems for their suitability to improve the assurance that systems meet security objectives. A specific verification system is evaluated with respect to the defined methodology. The main goals are to evaluate whether the verification system has the capability to express the properties of software systems and to evaluate whether the verification system can provide inter- level mapping, a feature required for understanding how a system meets security objectives.

DTIC

Program Verification (Computers); Software Engineering; Quality Control; Software Reliability

20030109145 Naval Postgraduate School, Monterey, CA

Developing Highly Predictable System Behavior in Real-Time Battle-Management Software

Caffall, Dale S.; Michael, James B.; Sep. 29, 2003; 49 pp.; In English

Report No.(s): AD-A417574; NPS-CS-03-006; No Copyright; Avail: CASI; A03, Hardcopy

Given that battle-management solutions in system- of-systems environment are separately designed and developed on various operating platforms in different languages, predicting battle-management behavior of system-of-systems is not possible. As a rule, battle management is executed at the system level rather than the desired system-of-systems level. Typically, C4 systems are non-real-time systems. Traditionally, weapon systems are real-time systems. If we are to match the performance of weapon systems and avoid the negative impact of forcing synchronization of battle manager software with weapon systems for messaging, then we must develop the battle manager as real-time software. We advocate the development of battle- management software as a real-time set of system functionality that addresses warfighter usage. To achieve the level of desired predictable battle-management behavior, we maintain that it is essential to develop a formal representation that captures the desired battle manager system behavior and test the formal representation against the expected battle-management properties. Furthermore, we assert that it is critical to develop the battle manager as a real-time software-intensive system to ensure the schedulability of battle- management tasks and provide for concurrent execution of such tasks where applicable.

DTIC

Mission Planning; Computer Systems Programs; Warfare

20030109281 George Mason Univ., Fairfax, VA

Understanding and Measuring Cognitive Workload: A Coordinated Multidisciplinary Approach

Boehm-Davis, Deborah A.; Gray, Wayne D.; Adelman, Leonard; Marshall, Sandra; Pozos, Robert; Sep. 2003; 46 pp.; In English

Contract(s)/Grant(s): F4962O-97-1-O353

Report No.(s): AD-A417743; AFRL-SR-AR-TR-03-0414; No Copyright; Avail: CASI; A03, Hardcopy

This research program was designed to develop predictive (based on cognitive modeling) and descriptive (based on physiological data) measures of cognitive workload that are highly correlated. Such measures must be theoretically grounded and empirically verified. Our main engineering goals in this project were to show: (1) how the predictive measures (cognitive modeling) could be applied to guide the design of novel interfaces and communication protocols for decision making tasks, and (2) how the descriptive measures (physiological) could be used to measure workload during real-time task performance.

DTIC

Human Performance; Tasks; Workloads (Psychophysiology)

20030109282

A Template-Based Planning Associate for Active Templates

Hoffman, Mark; Brackle, David Van; Jul. 2003; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-C-0052; DARPA ORDER-J764; Proj-ATEM

Report No.(s): AD-A417744; AFRL-IF-RS-TR-2003-169; No Copyright; Avail: CASI; A04, Hardcopy

The Active Templates program developed innovative planning tools for the Special Operations Forces community. These software tools were developed by several contractors. This report documents technology developed to help integrate those tools. Initially, a simple tool was developed for managing plans based on Plan and Goal Graphs. Applications could connect to this tool via sockets. Although the tool had a good set of functionality and was well received, it was clearly inadequate for the larger program. Using this tool as a base, a more sophisticated socket-based XML message passing tool, the Router, and a common data repository, the Plan Manager were developed. The two together constituted the Tool Interchange Manager (TIM). External to this effort, a set of database tables describing concepts shared among the tools was developed -the Structured Data Model (SDM). This effort was then tasked with maintaining the SDM. After off-the-shelf infrastructure was found to meet the infrastructure needs of the program, work was stopped on the TIM and efforts directed at creating an application to allow a higher-level commander to coordinate the finer-grained plans developed by the various Active Templates tools - the Plan Coordinator.
DTIC
Relational Data Bases; Templates

20030109319 Washington Univ., Seattle, WA
Operating System Services for Networked Clusters
Bershad, Brian N.; Levy, Henry M.; Jun. 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-97-2-0226; Proj-F214
Report No.(s): AD-A417680; AFRL-IF-RS-TR-2003-159; No Copyright; Avail: CASI; A03, Hardcopy

The Network Clusters project explored several key areas in the design and deployment of large scale computing clusters, including: communication, security, and services. In the area of communication, we developed a new computing infrastructure for partitioning protocols between the primary processor and an embedded co processor. Our solution is unique in that it is designed to allow new protocols to be run on the coprocessor without compromising the safety of previously installed protocols. In the area of security, we developed a new architecture for specifying and enforcing security properties on code that runs on an individual machine. Moreover, we designed a new distributed systems platform for securing networks of virtual machines. In the area of services, we developed a highly scalable cluster-based Mail service, capable of processing over 1 billion mail messages per day.
DTIC
Operating Systems (Computers); Computer Networks; Telecommunication

20030109331 South Carolina Research Authority, Charleston, SC
Rapid-Prototyping of Application Specific Signal Processors (RASSP) education and Facilitation
Gadient, Anthony; Richards, Mark A.; Frank, Geoffrey A.; Dec. 2000; 287 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-94-C-1457; Proj-A268
Report No.(s): AD-A417705; AFRL-IF-WP-TR-2003-1539; No Copyright; Avail: CASI; A13, Hardcopy

The Rapid-Prototyping of Application Specific Signal Processors (RASSP) program was a major DARPA/Tri-Service initiative to reinvent the process by which embedded digital signal processors were developed. The goal of the DARPA/Tri-service RASSP program was to dramatically improve the design process for complex digital systems, particularly embedded signal processors. A key objective was to reduce the total product development time by at least a factor of four while making similar improvements in product quality and life cycle cost. Also important was the ability to field state-of-the-art equipment at system build time and to rapidly upgrade the system throughout its life cycle. The RASSP Education and Facilitation (E&F) program was an unprecedented program set up to disseminate the information developed by 24 other RASSP programs to enable a paradigm shift in the way signal processors were designed. The RASSP E&F program is made up of four distinct functions: education, information server, interface, and transition. Major accomplishments include the establishment and maintenance of a web server, the publication of the 'RASSP digest', development of educational and training materials, and technology transfer including executive seminars, workshops, RASSP Course Modules, and IEEE publication of two RASSP CD-ROMs. The second edition of the RASSP CD-ROM presents the essence of the knowledge from the entire RASSP program. The web server has been relocated but is still operational.
DTIC
Education; Rapid Prototyping; Signal Processing; Applications Programs (Computers)

62
COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20030108675 Naval Postgraduate School, Monterey, CA
Development of an Information Security Awareness Training Program for the Royal Saudi Naval Forces (RSNF)
Alageel, Sami M.; Jun. 2003; 102 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417308; No Copyright; Avail: CASI; A06, Hardcopy

The Royal Saudi Naval Forces (RSNF) are vulnerable to the same kinds of threats to its information infrastructure as the rest of the industrialized nations, As an officer in the RSNF, I am familiar with the special information assurance needs and interests of my organization, and thus, I am in a position to leverage my formal Information Technology Management (ITM) education to address these needs, The USA has played a prominent lead role in establishing many educational curriculums in the area of information assurance (IA), Though the breadth and depth of educational curriculum and resource materials (i,e,, universities, certification programs, computer-based training, Web content, etc,) is impressive; the shear volume can be overwhelming and intimidating to the novice, What is needed is a methodical survey of the main IA themes that are currently emphasized by the most prominent and respected institutions offering IA training and education, This survey needs to be cross-referenced to identify core areas, and any other didactic information (e,g,, models, rules, best practices, etc,) that might prove useful in developing final training products for the RSNF.
DTIC
Security; Information Systems; Certification; Education

20030108769 Northrop Grumman Corp., Rome, NY, USA
Command, Control, Communications, Computer, Intelligence, Surveillance and Reconnaissance (C4ISR) Modeling and Simulation Using Joint Semi-Automated Forces (JSAF)
Trott, Kevin; Jun. 2003; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-98-D-0318; Proj-459S
Report No.(s): AD-A417477; AFRL-IF-RS-TR-2003-144; No Copyright; Avail: CASI; A03, Hardcopy

The objective for this effort was to establish a flexible C4ISR modeling and simulation framework based on the Joint Semi-Automated Forces (JSAF) software. This framework is to support cooperation and collaboration with Modeling and Simulation (M&S) efforts throughout AFRL. This effort involved the installation, maintenance, operation, training and interfacing of the JSAF simulation. This effort resulted in the installation of several versions of JSAF including supporting operating systems and MARCI; a tool to control multiple copies of JSAF or other federates from a single workstation. This effort investigated conflicts associated with installing and operating Soar intelligent agents within JSAF. Various Compact Terrain Database's (CTDB) were obtained and configured for JSAF. Demonstration scenarios were developed to analyze its capabilities along with a small Serbia-based scenario to support the JBI program. Other C4ISR systems and tools were investigated for inclusion within the framework. A model abstraction experiment was designed using the ALARM radar model in order to compare behaviors against those found in a comparable JSAF radar model. Attempts were made to integrate JSAF with a JView/Java-based visualization application via an HLA backbone. Many lessons learned resolved from this effort with respect to integration, collaboration and operation of systems and C4ISR frameworks.
DTIC
Computerized Simulation; Warning Systems; Telecommunication; Surveillance

20030108786 Naval Research Lab., Stennis Space Center, MS
Benchmarking the Performance of a Cluster-Based Geospatial Database System
Mahadevan, Venkata; Abdelguerfi, Mahdi; Shaw, Kevin; Jan. 2003; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417530; NRL/PP/7440--03-1015; No Copyright; Avail: CASI; A02, Hardcopy

The advent of inexpensive high performance computing clusters has opened the doorway to a wide range of applications that hitherto had been inconceivable. Such clusters can provide certain applications with a substantial boost in both compute and I/O performance. Therefore, it seems logical that Geographic Information Systems (GIS) applications would be an ideal fit for such systems. This paper presents a scheme to distribute geospatial data across several compute nodes in a cluster.

Several variations of this scheme are presented and the performance of each is benchmarked by using various geospatial queries to retrieve the data.
DTIC
Computer Networks; Low Cost; Geographic Information Systems

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20030108811 Naval Postgraduate School, Monterey, CA
Evolution: Advancing Communities of Practice in Naval Intelligence
Kendall, Raymond E.; McHale, Kevin J.; Jun. 2003; 109 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417552; No Copyright; Avail: CASI; A06, Hardcopy

The US Navy is embracing the principles of Knowledge Management (KM). One of the key components of KM is the Community of Practice. Communities of Practice are groups that form to share what they know, and to learn from one another regarding some aspect of their work. Organizations are strengthened through an improved network of contacts and enhanced productivity from their personnel. Personnel benefit through peer-group recognition and continuous learning. This thesis seeks to provide an understanding of how the Naval Intelligence Community, through the implementation of Communities of Practice, can reduce duplication of effort, increase collaboration between its personnel, and better support the resources in its people. In this thesis, we have provided a blueprint for building a successful unclassified Community of Practice for Naval Intelligence. This blueprint is designed to support replication on classified networks.
DTIC
Intelligence; Management; Navy

20030108814 Naval Postgraduate School, Monterey, CA
Using Commercial-Off-The-Shelf Speech Recognition Software for Conning U.S. Warships
Tamez, D. J.; Jun. 2003; 92 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417561; No Copyright; Avail: CASI; A05, Hardcopy

The U.S. Navy's Transformation Roadmap is leading the fleet in a smaller, faster, and more technologically advanced direction. Smaller platforms and reduced manpower resources create opportunities to fill important positions, including ship-handling control, with technology. This thesis investigates the feasibility of using commercial-off-the-shelf (COTS) speech recognition software (SRS) for conning a Navy ship. Dragon Naturally Speaking Version 6.O software and a SHURE wireless microphone were selected for this study. An experiment, with a limited number of subjects, was conducted at the Marine Safety International, San Diego, California ship- handling simulation facility. It measured the software error rate during conning operations. Data analysis sought to determine the types and significant causes of error. Analysis includes factors such as iteration number, subject, scenario, setting and ambient noise. Their significance provides key insights for future experimentation. The selected COTS technology for this study proved promising overcoming irregularities particular to conning, but the software vocabulary and grammar were problematic. The use of SRS for conning ships merits additional research, using a limited lexicon and a modified grammar which supports conning commands. Cooperative research between the Navy and industry could produce the Helmsman' of the future.
DTIC
Speech Recognition; Management; Data Processing

20030109174 Naval Postgraduate School, Monterey, CA, USA
Agent-Based Simulation of Robotic Systems
Williams, Manoleto Z.; Jun. 2003; 181 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417590; No Copyright; Avail: CASI; A09, Hardcopy

A goal and behavior agent layer Java Model was developed to simulate cruise, correct and avoid Control Modules in an autonomous agent (robot), The model was tested against a deterministic Figure of Merit (FOM) to predict a 'best mix' of

agents for the simplistic agent economy parameters given. Future works suggests validation of the model with real agents in a real economy.
DTIC
Robotics; Figure Of Merit; Robots

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20030108375 Scripps Institution of Oceanography, La Jolla, CA
Stratified Flow, Wave Packet Reflection and Topographic Currents
Carnevale, George F.; Dec. 31, 2002; 9 pp.; In English
Contract(s)/Grant(s): N00014-97-1-0095
Report No.(s): AD-A417212; UCSD-22-1133; No Copyright; Avail: CASI; A02, Hardcopy

A wide range of investigations was carried out under this grant. The topics covered by these investigations include vortex stability, vortex dynamics, flow interaction with topography, coastal dynamics, suppression of aircraft trailing vortices, convective and magnetohydrodynamic instability, and others. The results from this work have been reported in 11 refereed articles in prestigious journals, 10 articles in conference proceedings, and 37 formal presentations. The titles of these works are listed below, followed by an extended abstract of the work.
DTIC
Topography; Stratification; Wave Packets

20030108673 Naval Postgraduate School, Monterey, CA
Numerical And Experimental Study of the Performance of a Drop-Shaped Pin Fin Heat Exchanger
Boulares, Jihed; Jun. 2003; 91 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417333; No Copyright; Avail: CASI; A05, Hardcopy

This research presents the results or a combined numerical and experimental study or heat transfer and pressure drop behavior in a compact heat exchanger (CHE) designed with drop-shaped pin tins. A numerical study using ANSYS was first conducted to select the optimum pin shape and configuration for the CHE. This was followed by an experimental study to validate the numerical model. The results indicate that the drop shaped pin tins yield a considerable improvement in heat transfer compared to circular pin tins tor the same pressure drop characteristics. This improvement is mainly due to the increased wetted surface area of the drop pins, and the delay in the flow separation as it passes the more streamlined drop shaped pin tins. The data and conclusions of this study can he used in heat exchanger design tor large heat flux cooling applications as in gas turbine blades, and high-power electronics.
DTIC
Numerical Analysis; Heat Exchangers; Pins; Turbine Blades; Gas Turbines; Electronic Equipment

20030108678 South Carolina Univ., Columbia, SC
Advanced Wavelet Methods for Image and Signal Processing
DeVore, Ronald A.; Sep. 5, 2003; 7 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0547
Report No.(s): AD-A417316; No Copyright; Avail: CASI; A02, Hardcopy

The research on this contract was directed towards areas of mathematics and numerical computation which have applications to image/signal processing and PDEs. The research can be broadly classified into the following areas: (i) image processing, (ii) processing Digital Terrain Elevation Data (DTED), (iii) information theory, (iv) analogue to digital conversion, (v) approximation and (vi) theoretical and numerical PDEs.
DTIC
Signal Processing; Image Processing; Partial Differential Equations

20030109049 Naval Postgraduate School, Monterey, CA

Numerical and Experimental Analysis of the Performance of Staggered Short Pin-Fin Heat Exchangers

Hamilton, Leonard J.; Jun. 2003; 187 pp.; In English; Original contains color illustrations

Report No.(s): AD-A417377; No Copyright; Avail: CASI; A09, Hardcopy

A three dimensional finite element based numerical model was used to analyze the heat transfer characteristics of various staggered short pin-fin array heat exchangers. The simulation was validated against data from an experimental rig as well as historical data and then used to estimate the heat transfer coefficient and pressure drop for a wide range of Reynolds numbers for circular and airfoil-shaped pin fins. Circular pin configuration variations included changes in pin spacing, axial pitch and pin height ratio. Airfoil pin variations also included changes in length and aspect ratio. Correlations for Nusselt number and friction factor were developed. Using established performance metrics optimum configurations for both pin shapes were determined. The optimum airfoil pin array was shown to match the heat transfer rates obtained by the optimum circular pin configuration while incurring less than one third the specific fluid friction power loss. The results from this study would be of direct value in the design of a shroud enclosed heat exchanger concept being proposed for turbine blade cooling, or for cooling of high power electronic components, or in other high heat flux dissipation applications requiring a low-profile, high area-density based micro-heat exchanger design.

DTIC

Heat Transfer; Finite Element Method; Turbine Blades; Heat Transfer Coefficients

20030109327 California Inst. of Tech., Pasadena, CA

Filter Banks for Cyclic-Prefixing the Nonuniform DMT System

Vaidyanathan, P. P.; Vrcelj, Bojan; Jan. 2002; 5 pp.; In English

Contract(s)/Grant(s): N00014-99-1-1002

Report No.(s): AD-A417747; No Copyright; Avail: CASI; A01, Hardcopy

The cyclic prefix system is used in discrete multitone channels for frequency domain equalization. This is based on the inversion of samples of the channel frequency response at uniformly spaced points (DFT coefficients). In this paper we consider nonuniformly spaced samples of the channel frequency response, especially ocatve-spaced. The anticipated advantage is that for channels with rapidly decaying frequency responses, there are relatively fewer equalizer coefficients with unduly large values, and this helps to reduce amplification of channel noise at the receiver. We show how to combine a wavelet-like filter bank with traditional DFTs to achieve this goal. While the idea appears to be exciting and opens up interesting problems, its merits still remain to be evaluated.

DTIC

Signal Processing; Noise Reduction

20030109339 Worcester Polytechnic Inst., MA

Mathematical and Computational Issues in Advanced Plasma Microthrusters

Gatsonis, Nikolaos A.; Sep. 4, 2003; 10 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0278

Report No.(s): AD-A417710; AFRL-SR-AR-TR-03-0409; No Copyright; Avail: CASI; A02, Hardcopy

This mathematical and computational work investigated new issues that arise in the simulation of gas and plasma flows in microthrusters, plume flows and flows in associated devices. This research aimed overall at a unified mathematical formulation and numerical discretization of multi- species, partially ionized plasma micro-flows in nonequilibrium. The result is a seamless Particle In- Cell/Monte Carlo methodology developed on unstructured grids for flexibility and includes an adaptation feature. The methodology implemented elastic neutral-neutral, elastic ion- neutral and charge exchange ion-neutral collisions as well as a model for energy redistribution for rotational and vibrational degrees of freedom. The Poisson's equation solver is based on a finite-volume formulation that utilizes the Voronoi-Delaunay dual mesh. High-order particle/force weighting was implemented and the numerical heating was evaluated in unstructured simulations of a collisionless fully ionized plasma. The developed capability was applied to the simulation of gaseous microthruster and plume flows, the micro field emission array used with electric micropropulsion devices, the simulation of the plasma flow in a micro retarding potential analyzer, and to the simulation of ion beam neutralization phenomena.

DTIC

Thrustors; Plasma Engines; Iodine Lasers

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20030108435 Naval Undersea Warfare Center, Newport, RI
Statistical Analysis of Detection Performance for Large Distributed Sensor Systems
Wettergren, Thomas A.; Jun. 10, 2003; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417136; TR-11; TR-436; No Copyright; Avail: CASI; A03, Hardcopy

The problem of large-area coverage with a distributed set of short-range proximity sensors is investigated analytically. Analysis of the design tradeoffs between sensor range, sensor detection performance, and sensor false alarm performance is presented relative to the density of sensors in the field. Additionally, the impact of non- uniformity in sensor distribution on these performance assessments is quantified. The use of both individual sensor detections and coupled groups of sensor detections as a basic track-determination strategy is examined. Finally, guidance is included on strategies for making sound engineering tradeoffs based on the analytical results.
DTIC
Detection; Statistical Analysis; Sound Detecting and Ranging; Remote Sensors

20030108790 Naval Postgraduate School, Monterey, CA
Determining the Number of Officers to Graduate from the Naval School and the Number of Naval School Graduated Officers to Promote by Rank in Order to Meet Actual and Future Needs of the Mexican Navy
Davila, Fidencio V.; Jun. 2003; 129 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417535; No Copyright; Avail: CASI; A07, Hardcopy

The Mexican Navy is challenged with too few 0-1 to 0-3 officers and too many 0-6 to 0-9 officers. This research developed three models to explain the challenge. Through the use of a transition probabilities matrix model one predicts the number of graduates from the Mexican Naval School based on accessions. Model two is a transition probability matrix that uses model one's output to forecast the distribution of Naval School Graduate Officers (NSG0) by grade over the next ten years. Model three is a non-linear objective function that observes gaps between expected inventory and demand of NSG0 over the same period.
DTIC
Forecasting; Inventories; Navy; Probability Theory

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20030108374 Office of Naval Research, Arlington, VA
Science and Technology Asset Management: Optimizing Multi-Program Multi-Year Resource Allocations
Kostoff, Ronald N.; Stanford, L. B.; Nov. 1988; 46 pp.; In English
Report No.(s): AD-A417206; No Copyright; Avail: CASI; A03, Hardcopy

The Office of Naval Research (ONR) funds research that will benefit the U. S. Navy. In managing this research, ONR must allocate resources to achieve maximum benefits within its resource constraints. This report addresses one aspect of the resource allocation problem, namely, identifying funding profiles (normalized program funds as a function of time) for programs, or groups of programs, that provide maximum adherence to some predetermined policy. Four examples are presented in this report. The first describes selection of an overall funding profile for a group of special programs called Accelerated Research Initiatives (ARIs). The profile was selected to ensure an infusion of new ARIs proportional to total budget, and the actual turnover of ARIs resulting from use of the profile is shown. The second example shows how, with the use of quadratic programming, additional constraints could be placed upon the funding profiles, if desired, and relatively stable ARI turnover would still result. The third example describes the use of quadratic programming in an experiment in which each member of a group of potential programs had maximum funding profile flexibility while obeying the group funding ceiling constraints. The fourth example describes an extension of the methodology of the third example that could be applied to determining the profiles of every program in any funding organization.
DTIC
Research and Development; Resource Allocation

20030108407 Naval War Coll., Newport, RI

Social Systems Analysis: The Future of Operational Intelligence?

Garraghty, Van; May 15, 2003; 24 pp.; In English

Report No.(s): AD-A417225; No Copyright; Avail: CASI; A03, Hardcopy

Does social systems analysis provide the Joint Force Commander (JFC) with an advantage over a potential adversary? Joint Forces Command (JFCOM) believes the answer is 'yes' by virtue of experiments and concept development work, including that accomplished in MILLENIUM CHALLENGE 2002. They assert that adding this type of analysis to more traditional forms of intelligence products (e.g., Joint Intelligence Preparation of the Battlespace) provides the JFC with more options for employing lethal and nonlethal forms of national power. Academics and complex adaptive systems experts are not as hopeful. They cite the inherent unpredictability of human- centered activities, whether they are at the individual or group level. While the idea of incorporating social systems analysis in the JFC's intelligence toolkit is appealing, it has significant risks. Systems dynamics experts believe social theory is too imprecise and subjective to provide a sound foundation for systems analysis. Moreover, social systems analysis often blends theories, assumptions, and facts. This results in knowledge bases and representative analytical models that appear valid, but may not account for either unknowable facts (e.g., human perceptions) or extemporaneous factors known only by the adversary. The result may be a false sense of security in the validity of intelligence assessments that are based on social systems analysis. The critical patterns and trends that underlie adversary systems can be modeled. The challenge is to segregate subjective analysis from facts. A well-designed model that does so may provide the JFC with the ability to visualize the otherwise abstract idea of effects-based operations.

DTIC

Military Operations; Knowledge Based Systems; Systems Analysis; Decision Support Systems; Intelligence

20030108457 Colorado State Univ., Fort Collins, CO

Interactive Anticipatory Scheduling for Two Military Applications

Howe, Adele; Whitely, L. D.; Aug. 12, 2003; 34 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0144

Report No.(s): AD-A417171; AFRL-SR-AR-TR-03-0320; No Copyright; Avail: CASI; A03, Hardcopy

Application of scheduling technologies lags significantly behind the state-of-the-art. This project investigated two contributors to this lag. First, researchers do not know what makes particular problems difficult for their methods. Second, researchers often develop methods in isolation from actual data and applications. To address the first, new static and the first dynamic models of local search algorithms have been developed; these models partially explain what makes some job shop scheduling problems difficult. For the second, several algorithms for Air Force Satellite Control Network scheduling have been compared on historical and recent data. Additionally, a prototype interactive scheduler has been built that includes the algorithm and objective functions.

DTIC

Scheduling; Artificial Intelligence; Military Technology

20030108466 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

A Generalized Decision Support System for the Contracting Career Field

Mercier, Larry D., Jr; Mar. 2002; 120 pp.; In English

Report No.(s): AD-A417204; AFIT/GAQ/ENS/02-02; No Copyright; Avail: CASI; A06, Hardcopy

This research effort develops a generalized decision support system (DSS) to assist contracting career field managers in making recruiting and retention decisions. The DSS focuses on the skill level inventories of the contracting enlisted force. The interest in this research was identified by contracting career field managers due to the recent negative trends in recruitment and retention and the lack of analytical tools available. To accomplish this objective manpower models were developed using a combination of techniques gathered through interviews with Army and Air Force analysts and a literature review focusing on manpower modeling. The models developed in this study are intended to assist career field managers in recruiting and retaining the correct number and skill level mix of personnel in the contracting career field. The models are generalized enough to serve as a DSS for other Air Force Specialty Codes (AFSC) with minimal revision.

DTIC

Decision Support Systems; Personnel Development; Manpower

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20030108378 Naval Underwater Systems Center, New London, CT
Application of Linear Predictive Spectral Analysis to Multiple Tones in Noise
Nuttall, Albert H.; Dec. 12, 1979; 58 pp.; In English
Contract(s)/Grant(s): Proj-A75205
Report No.(s): AD-A417257; NUSC-TM-791218; No Copyright; Avail: CASI; A04, Hardcopy

An application of linear predictive spectral analysis, in particular the forward-and-backward averaging procedure, to tones in noise is made. The accurate tone- frequency estimation capability and lack of tone-splitting make this an attractive technique for spectral analysis and estimation of tone amplitudes. The effect of inadequate pole- order on the spectral estimate in white and colored noise is investigated in a number of examples. The examples here indicate that the linear predictive technique should receive wider application for spectral analysis in the realm of underwater acoustics. Two programs in BASIC for the Hewlett Packard 9845 for the cases of real and complex data have been written and are available from the author; they are modifications to the original program in FORTRAN written by S. L. Marple.
DTIC
Underwater Acoustics; Spectrum Analysis

20030108685 Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ
Euler Angles and Quaternions in Six Degree of Freedom Simulations of Projectiles
Amoruso, Michael J.; Mar. 1996; 75 pp.; In English
Report No.(s): AD-A417259; No Copyright; Avail: CASI; A04, Hardcopy

When developing simulations of aircraft, missiles or gun-launched projectiles, investigators require a coordinate frame in which to follow the motion. Newton's laws require an inertial (unaccelerated) frame. The earth is a convenient reference frame but is not inertial since the earth rotates. The earth may nonetheless be used, with Coriolis and centripetal accelerations included to account for the earth's rotation. However, the projectile is both translating and rotating. Thus it is convenient to express the equations of motion of the projectile, missile or aircraft in coordinates that move along with it in some way. The obvious choice is body-fixed coordinates. These coordinates are attached to the projectile or aircraft and roll, pitch and yaw with it. The reader familiar with gimbals or gyroscopes will recognize that these Euler angles of roll, pitch and yaw are equivalent to gimbal angles. In the case of a guided projectile, the seeker, rate sensor, accelerometers, and control mechanisms whether aerodynamic or reaction control all operate in and are easiest to describe in body-fixed coordinates.
DTIC
Degrees Of Freedom; Equations Of Motion; Projectiles; Quaternions; Computerized Simulation

20030109277 Society for Industrial and Applied Mathematics, Philadelphia, PA
SIAM Conference on Applications of Dynamical Systems. May 27-31, 2003, Snowbird Ski & Summer Resort, Snowbird, UT
May 31, 2003; 221 pp.; In English
Report No.(s): AD-A417739; No Copyright; Avail: CASI; A10, Hardcopy

The SIAM Activity Group on Dynamical Systems provides a forum for the exchange of ideas and information between mathematicians and applied scientists whose work involves dynamical systems. The goal of this group is to facilitate the development and application of new theory and methods of dynamical systems. The techniques in this area are making major contributions in many areas, including biology, nonlinear optics, fluids, chemistry, and mechanics. This activity group sponsors special sessions at SIAM meetings and conferences, organizes a biennial conference, and has an electronic newsletter.
DTIC
Dynamical Systems; Nonlinear Optics; Computational Fluid Dynamics

70
PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20030108373 Army Armament Research, Development and Engineering Center, Watervliet, NY

Erosion Modeling of the High Contraction Chromium Plated Crusader Gun System

Sopok, S.; Rickard, C.; Pflegl, G.; O'Hara, P.; Dunn, S.; Jun. 2003; 36 pp.; In English

Report No.(s): AD-A417200; ARCCB-TR-03008; No Copyright; Avail: CASI; A03, Hardcopy

Thermal-chemical- mechanical erosion modeling predictions are given for the high contraction chromium plated Crusader gun system based on extensive cannon firing, inspection, characterization, and experimental data. This effort was conducted for the Army's Crusader Program Manager Office and managed by Applied Ordnance Technology. The authors carefully protect proprietary technical data that was provided by various government and nongovernment partners involved in this effort. Key gun system details include the 155-mm 56 caliber rifled XM297 cannon with a 1400 In(3) chamber, zone six combustible case-type modular artillery charge, triple- base propellant, an approximately 100-pound M549-like projectile, its nominal obturator, maximum chamber pressure of approximately 55 kpsi, 0.005-inch thick high contraction chromium plate on both the lands and grooves of the steel, ambient temperature conditioning, no in-wall barrel cooling, decopperlng and flash additives, and no wear additives. This XM297 gun system can be condemned on erosion due to loss of velocity, fuse malfunction, rotating band wear, excessive body engraving, and loss of accuracy. A provisional 0.105-inch diametric origin erosion limit (usually at 12:00 to 6:00 peak) applies in the absence of these condemning effects as measured by pullover or star gages. Most key cannons were near this provisional diametric erosion limit and were destructively characterized resulting in moderately high confidence erosion predictions. Thermal and erosion predictions are made for five different firing rate scenarios from 1 round per hour to 8 rounds per minute. For the I round per hour firing rate scenario, we predict that it requires approximately 1520 EFCs to achieve arbitrary 0.100-inch wall erosion at the 12:00 o'clock peak eroded origin position and 1005 EFCs to achieve arbitrary 0.100-inch diametric erosion at the 12:00 to 6:00 o'clock peak eroded origin position.

DTIC

Erosion; Chromium Alloys; Guns (Ordnance)

20030108414 Army Research Lab., Aberdeen Proving Ground, MD, USA

An Approximate Method for Pitch-Damping Prediction

Danberg, James E.; Weinacht, Paul; Jul. 2003; 44 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-IL1612618AH80

Report No.(s): AD-A417242; ARL-TR-3007; No Copyright; Avail: CASI; A03, Hardcopy

A simple method of estimating the pitch-damping coefficients for axisymmetric flight bodies has been developed. The method is suitable for preliminary design and parametric studies. The procedure is based on concepts from slender body theory, but the method significantly improves the accuracy of the results through the use of correlation functions. To derive the correlation functions, extensive use of a recently developed and validated computational fluid dynamics (CFD) method for predicting the pitch-damping coefficients has been employed. The CFD method provides important details necessary to derive the correlation functions that are unavailable from the current experimental database. The method has been validated for a variety of nose geometries, body lengths, and Mach numbers using both experimental and computationally generated databases.

DTIC

Damping; Computational Fluid Dynamics; Approximation; Pitch (Inclination)

20030108471 Army Engineer Research and Development Center, Vicksburg, MS, USA

Assessment of Environmental and Economic Benefits Associated With Streambank Stabilization and Phosphorus Retention

Hubbard, Lisa C.; Bledenharn, David S.; Ashby, Steven L.; May 2003; 15 pp.; In English

Report No.(s): AD-A417227; ERDC-WQTN-AM-14; No Copyright; Avail: CASI; A03, Hardcopy

This technical note documents the assessment of potential water quality improvements and economic impacts associated with streambank stabilization and phosphorus retention. Phosphorus (P) comes from both point sources (e.g., sewage effluents and industrial discharge) and nonpoint sources (e.g., urban, agricultural, and forest runoff). Measures to control point source pollution (e. g., constraints on P-based inputs) were implemented with the 1972 U.S. Clean Water Act. Recent environmental

management efforts have focused on the control of nonpoint sources of contaminants. Erosion and subsequent transport of sediment-bound phosphorus from streambanks can provide a major source of bioavailable phosphorus to aquatic systems. Reduction in the availability of phosphorous (and sediment, and nitrogen), associated with streambank stabilization provides potential economic benefits through reduced treatment costs and adverse environmental impacts. Recent studies in the Demonstration Erosion Control (DEC) Project in Mississippi have indicated that nationwide, costs for phosphorus removal range from $8.82 to $1113.32 per. kg ($4 to $505 per pound) of phosphorus (Watson et al. 2001). This suggests that the potential financial benefit associated with streambank stabilization measures and subsequent phosphorus retention could be significant.
DTIC
Economic Impact; Erosion; Environment Management; Phosphorus; Retention

20030108772 Army Engineer Research and Development Center, Vicksburg, MS, USA
A Study of Effective Moment of Inertia Models for Full-Scale Reinforced Concrete T-Beams Subjected to a Tandem-Axle Load Configuration
Wickline, Joseph E.; Cousins, Thomas E.; Seda-Sanabria, Yazmin; Aug. 2003; 103 pp.; In English
Report No.(s): AD-A417481; ERDC/GSL-TR-03-12; No Copyright; Avail: CASI; A06, Hardcopy

This study focuses on some of the research efforts from the U.S. Army Engineer Research and Development Center (ERDC) in developing more accurate procedures for the estimation of the load-carrying capacity of in-service fixed bridges, in particular, of reinforced concrete T-beam bridges. This bridge type represents a stumbling block for U.S. Army field engineers whenever they are faced with unknown important parameters for load capacity estimation such as the amount and location of the flexural reinforcement in the T-beam girder cross sections. Research personnel from the ERDC in collaboration with personnel from the Virginia Polytechnic Institute and State University worked in the development of a procedure that is potentially more accurate, can be quickly executed in the field, and is relatively easy to use by military engineers. The evaluation procedure presented herein provides a methodology for transition between the quantity of flexural reinforcement in a reinforced concrete T-beam and the member's actual moment of inertia. This report is aimed at the evaluation of the accuracy of selected, effective moment of inertia models as a component in the proposed evaluation procedure. The accuracy of the selected models is evaluated using laboratory test data generated from an experimental program detailed herein, which included the load testing of full-scale reinforced concrete T-beams. The test specimens were subjected to a closely spaced, tandem-axle load configuration, which represents a typical load configuration in military equipment.
DTIC
Loads (Forces); Load Carrying Capacity; Concretes

20030108807 Naval Postgraduate School, Monterey, CA
Wave Propagation Over Complex Bathymetry
Ray, Timothy A.; Jun. 2003; 54 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417551; No Copyright; Avail: CASI; A04, Hardcopy

Swell propagates across thousands of kilometers of ocean in almost unchanged parallel wave fronts. Within the nearshore region however, refraction causes wave fronts to turn toward shallow depths transforming the wave field. The Nearshore Canyon Experiment (NCEX) Pilot, conducted from October 10 to October 17, 2002, observed wave transformation across the Scripps and La Jolla canyon system near San Diego, CA. Four Datawell Directional Waverider Buoys, three Nortek Vector PUV recorders, and two pressure sensors were deployed in depths ranging from 10 to 300 m. Observed energy density spectra and mean propagation directions were examined for three case studies representative of the range of observed swell conditions. Observations were compared to predictions of a back-refraction model provided by Dr. William O'Reilly. Observations indicate that refraction causes the waves to propagate along the deep axes of the Scripps and La Jolla canyons. At the shallow canyon heads, the convergence and divergence of ray trajectories cause extreme (2-3 orders of magnitude) spatial variations in wave energy. Considering the complexity of the canyon environment, predictions of wave transformation agree surprisingly well with observations.
DTIC
Wave Propagation; Bathymeters; Flux Density

20030109054 Air Force Research Lab., Eglin AFB, FL
Nanoscience Technology
Armstrong, Ronald W.; Sep. 2003; 195 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-2306
Report No.(s): AD-A417640; AFRL-MN-EG-TR-2003-7111; No Copyright; Avail: CASI; A09, Hardcopy

This technical report is a compilation of unclassified articles, presentations, briefings, etc., produced by R.W. Armstrong, Senior Scientist, AFRL/MNME, mostly in collaboration with Air Force Research Laboratory, Munitions Directorate, Energetic Materials Branch and external national and international colleagues, during the three year period: October 2000 through August 2003. The topical items are mostly centered on dislocation mechanics model descriptions of the total deformation and cracking behaviors of energetic materials and/or structural metals, in the latter case, subjected to high rate loading conditions as experienced in explosive detonations. Additional items referenced are: (1) the forthcoming textbook in print 'Deformable Bodies and Their Material Behaviors', co-authored with Henry W. Haslach, Jr.; and, (2) an article on 'The Seeds of Tornado Prevention', co-authored with Joseph G. Glenn, and associated with the listed patent disclosure 'Tornadic Disruption Through Nanometric Sized Cloud Seeding'. The latter items represent a 'spin-off' connection of Eglin Air Force Base research interest in the strength and energy release rate properties of energetic/reactive nanomaterials, as shown here to relate to an appreciable number of the described items.
DTIC
Deformation; Reactivity; Nanotechnology

20030109061 International Centre for Theoretical Physics, Trieste
Symposium on Synchronization of Chaotic Systems, 3- 5 July 2000. Trieste, Italy
Jul. 2000; 83 pp.; In English
Report No.(s): AD-A417456; No Copyright; Avail: CASI; A05, Hardcopy

The Symposium took place at the Abdus Salam International Centre for Theoretical Physics, Trieste, Italy from 3-5 July 2000. The two main thrusts were: (1) synchronization of systems of small numbers of elements, often two, such as lasers and circuits with applications to communications; and (2) ordering, synchronization and clustering in systems of large populations of elements with applications in biology and chemistry. This report consists of a symposium summary, participant list and the program with short abstracts.
DTIC
Signal Processing; Physics; Synchronism; Chaos

20030109073 Colorado Univ., Colorado Springs, CO, USA
Physics of Magnetic Multilayers and Devices at Millimeter Wave Frequencies
Celinski, Zbigniew J.; Camley, Robert E.; May 2003; 52 pp.; In English
Report No.(s): AD-A417403; ARO-41078.1-PH; No Copyright; Avail: CASI; A04, Hardcopy

Microwave devices are widely used in both military and civilian communications systems. During the last decades, we have witnessed incredible progress in high frequency semiconductor electronics and, in particular, a movement towards the synthesis of different electronic components into integrated circuits. The obvious obstacle, however, to an increased use of microwave and millimeter wave technology is the lack of advances in magnetic structures at high frequencies, 10-100 GHz. The main goal of this project was to look at both fundamental and applied physics relating to high frequency (10-100 GHz) waves in magnetic materials and devices. We have developed three different signal processing devices:, tunable band stop and band pass filters and tunable phase shifters based on the ferromagnetic metals. We demonstrated operation of these devices at frequencies up to 30 GHz in low magnetic fields.
DTIC
Millimeter Waves; Bandpass Filters; Magnetic Materials

20030109092 Naval Postgraduate School, Monterey, CA
Design and Cold-Flow Evaluation of a Miniature Mach 4 Ramjet
Ferguson, Kevin M.; Jun. 2003; 85 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417466; No Copyright; Avail: CASI; A05, Hardcopy

Methods used for designing the ramjet included conic shock tables; isentropic flow tables and the GASTURB code was used for aerothermodynamic performance prediction. The flow field through the proposed geometry was computed using the OVERFLOW code, and small modifications were made. Geometry and solid models were created and built using SolidWorks 3D solid modeling software. A prototype ramjet was manufactured with wind tunnel mounting struts capable of measuring axial force on the model. Shadowgraph photography was used in the Mach 4 supersonic wind tunnel at the Naval Postgraduate School's Turbopropulsion Laboratory to verify predicted shock placement, and surface flow visualization was obtained of the

airflow from fuel injection ports on the inlet cone of the model. All indications are that the cold-flow tests were successful.
DTIC
Computational Fluid Dynamics; Ramjet Engines; Aerothermodynamics

20030109100 George Mason Univ., Fairfax, VA, USA
Adaptive Beampattern Control Via Linear and Quadratic Constraints for Circular Array STAP
Bell, Kristine L.; Dec. 2002; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-00-1-0337
Report No.(s): AD-A417462; No Copyright; Avail: CASI; A03, Hardcopy

A general framework for adaptive and non-adaptive space-time beampattern synthesis using quadratic beampattern constraints with linearly constrained minimum variance (LCMV) beamforming has been developed. Main beam and sidelobe pattern control is achieved by imposing a set of inequality constraints on the weighted mean-square error between the adaptive pattern and a desired beampattern over a set of angle- Doppler regions. An iterative procedure for satisfying the constraints is developed which can be applied as post- processing to standard LCMV beamformers. The algorithm is used to synthesize a nearly uniform sidelobe level quiescent pattern for the circular UHF Electronically Scanned Array (UESA), and to control sidelobe levels for the same array in an adaptive manner. The technique has been generalized for general rank reducing transformations to reduce computational complexity. Performance results using data provided by Lincoln Lab show that under low sample support conditions, sidelobes can be effectively suppressed while maintaining high signal-to- interference plus noise ratio, and deep nulls on clutter and interferers.
DTIC
Numerical Analysis; Beamforming; Adaptive Control

20030109311 Trinity Univ., San Antonio, TX
Biomarker of Radio Frequency Radiation Exposures
Blystone, Robert V.; Kalns, John E.; Sep. 15, 2003; 24 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0152
Report No.(s): AD-A417677; AFRL-SR-AR-TR-03-0402; No Copyright; Avail: CASI; A03, Hardcopy

Tissue nitration due to environmental heating (EH) may be tied to availability of NOx in the lungs. Hemorrhagic mimics of EH/MMW (millimeter wave) blood pressure drops showed no increase in NOx levels. Nitration levels did spike as temperature increased with MMW exposure. Infrared heating could not be matched to MMW heating profiles. Histological examination did reveal a pronounced response 35GHz exposure at long.
DTIC
Biomarkers; Exposure; Infrared Radiation; Histology

20030109329 Naval Postgraduate School, Monterey, CA
DC-DC Power Conversion With Galvanic Isolation
Zengel, Jason A.; Jun. 2003; 103 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417701; No Copyright; Avail: CASI; A06, Hardcopy

As the navy transitions to all electric warships, there will be many changes to the power distribution schemes found aboard ships today. It will be necessary to maintain reliability while supplying the various components onboard with the proper voltage levels, since transformers cannot be used to alter voltage levels while providing galvanic isolation in DC power systems, it is necessary to find an efficient method to incorporate the increased safety provided by galvanic isolation in a DC power distribution system. This thesis examines the design and control of one possible element for a future Electrical Distribution System (EDS), a DC-DC converter with galvanic isolation. The main purpose of this study is to provide a working model with associated theoretical proof and simulations. MATLAB will be used to provide observations of the converter's operation and the success of the control scheme implemented. Future work on this topic will be assisted by the inclusion of a parts list as well as recommendations for enhancing the prospects of this technology.
DTIC
Voltage Converters (Dc To Dc); Electric Power; Electrolytic Cells; Transformers

20030109337 Kansas Univ., Lawrence, KS
Coating Conductors with the Highest-Tc Hg-Based Superconductors
Wu, Judy; Apr. 2003; 6 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0303; Proj-2305
Report No.(s): AD-A417665; KUCR-22920; AFRL-SR-AR-TR-03-0437; No Copyright; Avail: CASI; A02, Hardcopy

This project started on April 1, 2000 and was completed on April 30, 2003. The overall goal of the project in to develop novel processes, such as the cation exchange process, for epitaxy of Hg-based high temperature superconducting (Hg-HTS, mainly Hg-1212 of T (sub c)^125 K and Hg-1223 of T(sub c) ^135 K <) thin films on metal substrates. Four students were partially supported during the reporting period. Research on the two research objectives has been carried out in parallel and exciting progress has been made, as summarized in the following. Details of our results may be found in 1 book chapter, 28 papers (24 published/accepted, and 4 submitted), 1 US patent awarded and 2 patent disclosures submitted. In addition, two Ph.D. students graduated during the project period. Dr. Yiyuan Xie graduated in March of 2002 and joined IGC immediately afterwards and Dr. Roberto Aga, in December 2002 with honor, and now stay as a postdoctoral research at the University of Kansas.
DTIC
Mercury (Metal); High Temperature Superconductors

71
ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20030108740 Naval Undersea Warfare Center, Newport, RI
High Efficiency Parametric Sonar
Ruffa, Anthony A., Inventor; Mar. 24, 2003; 14 pp.; In English
Patent Info.: Filed 24 Mar. 2003; US-Patent-Appl-SN-10400086
Report No.(s): AD-D020089; No Copyright; Avail: Other Sources

A parametric sonar for use in a liquid medium includes a first signal generator which transmits a first acoustic signal and a second signal generator transmitting a second acoustic signal which interact to produce a difference frequency signal at an interference region. A cavitation generator is provided to transmit a cavitation acoustic wave causing cavitation vapor bubbles in the liquid medium at the interference region. The cavitation vapor bubbles improve the efficiency of generating the difference frequency signal.
DTIC
Signal Generators; Sonar; Sound Waves

20030108741 Naval Undersea Warfare Center, Newport, RI
Adaptive Sonar Signal Processing Method and System
Carter, G. C., Inventor; Adal, Berhane, Inventor; Apr. 14, 2003; 16 pp.; In English
Patent Info.: Filed 14 Apr. 2003; US-Patent-Appl-SN-10404654
Report No.(s): AD-D020090; No Copyright; Avail: Other Sources

A method and system for processing received sonar signals. The method and system generate bearing data signals based on the received sonar signal. The method and system continuously determine the signal strength of the received sonar signal and also continuously determine the total noise from the received sonar signal in the ocean environment in which the target is located. The method and system provide a sensor gain in response to the determined total noise and the signal strength, and adaptively calculate filter coefficients from the sensor gain and the determined total noise. The method and system also filter the generated bearing data signals using a filter having the calculated filter coefficients.
DTIC
Signal Processing; Sonar

20030108767 Army Engineer Research and Development Center, Vicksburg, MS, USA
Response of Wild Rice to Selected Aquatic Herbicides
Nelson, Linda S.; Owens, Chetta S.; Getsinger, Kurt D.; Sep. 2003; 20 pp.; In English
Report No.(s): AD-A417366; ERDC/EL-TR-03-14; No Copyright; Avail: CASI; A03, Hardcopy

The invasion of exotic plants such as Eurasian watermilfoil (Myriophyllum spicatum L.) has contributed to the decline and displacement of native wild rice (Zizania aquatica L.) populations in many U.S. water bodies. Wild rice is a popular food source for both man and animal and provides important habitat for waterfowl, invertebrates, and fish. Herbicides can be successfully used to manage invasive weeds such as Eurasian watermilfoil; however, the potential impacts of such chemical management techniques on native plants (including wild rice) are not well documented. This outdoor tank study was

conducted to examine the effects of several aquatic herbicides on the growth and survival of wild rice and to determine whether nontarget herbicide efficacy is influenced by wild rice growth stage. Aquatic formulations of the herbicides diquat, endothall, fluridone, and 2,4-D were applied at varying rates and contact times to three growth stages of wild rice. Results showed that degree of herbicide injury varied with plant growth stage. Wild rice treated at younger growth stages (early tillering or seedling stages) was more sensitive to chemical treatment than plants treated at later stages of development. Regardless of product or rate, herbicide treatment did not affect wild rice plants when applied at the mature growth stage (late tillering and flowering). Of the herbicides evaluated, wild rice was most sensitive to 2,4-D. Rates as low as 1 mg 2,4-D L-significantly inhibited tiller, seedhead, and dry weight biomass production in young wild rice. Dry weight of young wild rice was also reduced following exposure to endothall, diquat, and fluridone; however, seedhead and tiller production was not influenced by these products.
DTIC
Herbicides; Aquatic Plants; Rice; Plants (Botany); Vegetation Growth

20030108768 Army Engineer Research and Development Center, Vicksburg, MS, USA
Invasion of Eurasian Watermilfoil in Lakes of the Western Upper Peninsula, Michigan
Skogerboe, John G.; Poovey, Angela G.; Getsinger, Kurt D.; Kudray, Greg; Aug. 2003; 64 pp.; In English
Report No.(s): AD-A417368; ERDC/EL-TR-03-10; No Copyright; Avail: CASI; A04, Hardcopy

Eurasian watermilfoil (Myriophyllum spicatum L.) has the potential to cause major long- term adverse environmental, recreational, and aesthetic impacts to the pristine lakes in the western Upper Peninsula of Michigan. At the request of the U.S. Army Engineer District, Detroit, the U. S. Army Engineer Research and Development Center evaluated 16 lakes in Gogebic County, first to verify if Eurasian watermilfoil was present in the lakes, and then to recommend spot-treatment control options for pioneer infestation of the exotic species. Surveys were conducted using a sampling grid and global positioning system method. Of the lakes surveyed, only two contained small infestations of Eurasian watermilfoil. Occurrences of rare, threatened, or endangered aquatic plants were documented during the lake evaluations.
DTIC
Water Pollution; Lakes; Aquatic Plants; Infestation

20030108775 Naval Research Lab., Stennis Space Center, MS
Environmentally Adaptive and Through-the-Sensor Efforts at NRL
Harris, Mike; Avera, Will; Bibee, Dale; Walter, Don; Bourgeois, Brian; Sep. 2003; 12 pp.; In English
Report No.(s): AD-A417525; NRL/PP/7440--03-1021; No Copyright; Avail: CASI; A03, Hardcopy

The Naval Research Laboratory's Marine Geosciences Division is conducting research in Through-The-Sensor and Environmentally Adaptive Sensor Techniques. NRL's AutoSurvey(TM) system is an environmentally adaptive technique developed to minimize survey time in an area while obtaining the desired seafloor coverage. The effective swath of a multibeam survey system depends on water depth, sound velocity conditions, seafloor properties, and sensor settings. AutoSurvey monitors these conditions and using intelligent navigation adjusts ship track accordingly to achieve a desired swath overlap. The real-time system processes the edge of good swath data at the end of each survey line and lays down the next survey line on the fly based on actual coverage. As a result excessive overlap in deep areas and data gaps in shoal areas are avoided. AutoSurvey timesavings are slope dependent. Results from actual surveys have demonstrated timesavings of 10% with as little as loot slope, and up to 60% for rugged terrain. AutoSurvey has been transitioned to the Naval Oceanographic Office (NAVOCEANO) for use on their T-AGS vessels. Additionally NRL has worked with ARL/UT in the development of a real- time situational awareness tool for the SQQ-32 mine hunting sonar. In this environmentally adaptive technique, real-time reverberation statistics from the SQQ-32 end target signal computations involving the sound speed profile are used to compute sonar detection performance. The Sonar Performance Monitoring System displays detection performance as a function of bearing and range in four colors, good to poor, responsive to changing environmental conditions and the sonar configuration. Through-The-Sensor (TTS) concepts use fleet assets to collect tactical environmental data that can be used to refresh the environmental picture. NRL's Acoustic Seafloor Classification System (ASCS) uses inversion and signal processing techniques to determine acoustic impedance and seafloor properties.
DTIC
Sound Detecting and Ranging; Bathymeters; Adaptive Control; Acoustic Impedance

20030108776 Naval Postgraduate School, Monterey, CA
Acoustic Based Tactical Control of Underwater Vehicles
Marr, William J.; Jun. 2003; 198 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417526; No Copyright; Avail: CASI; A09, Hardcopy

Advances in command and control of Autonomous Underwater Vehicles (AUVs) using acoustic communications are crucial to future Fleet objectives, particularly in Very Shallow Water Mine Countermeasures (VSW MCM). Understanding of the capability to redirect missions, provide relatively high rate downloads of mission information, and perform cooperative tracking for multi-vehicle systems is cunently limited to some bounding data based on fixed node expenments while the impact of working in the environment presented by a moving vehicle is not understood. The main objectives of this dissertation were to investigate and demonstrate the capabilities of tactical acoustic control of a dynamic, operational underwater vehicle in the Very Shallow Water (VSW) ocean environment. This necessarily required studies on the limitations of Acoustic Control and relatively High Data Rate Transfer when using commercial acoustic modems in underwater vehicles, and an investigation of their acoustic transmission characteristics. Comprehensive empirical evidence through field validation with the ARIES vehicle indicated that reduced ranges were required for successful acoustic communications in a realistic very shallow water environment. Background noise, multipath reflections, and vehicle induced Doppler shifts all limit the communication link. Occasionally, configurations may be found where vehicle body shielding against multipath destructive interference can be used to advantage. A simulation was developed to demonstrate a solution for reducing the range and conducting multi-vehicle behaviors for cooperative tracking and acoustic communications data transfer.
DTIC
Underwater Vehicles; Underwater Acoustics; Communication; Sound Transmission; Communication Networks; Acoustic Propagation

20030109340 Massachusetts Inst. of Tech., Cambridge, MA
Relaxor Ferroelectric Single Crystal Based Hybrid Actuator for Underwater Acoustic Noise Generation
Hagood, Nesbitt W., IV; May 2002; 1460 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-01-1-0857
Report No.(s): AD-A417716; No Copyright; Avail: CASI; A99, Hardcopy

This report details the development of a microfabricated pump for underwater acoustic noise generation. The goal of MicroHydraulic Transducer (MHT) technology is to provide high power density servohydraulic actilation systems that can be used in a variety of applications. Hydroacoustic actuation is a good application for such technology. The goal here is to develop an acoustic noise source capable of radiating approximately 0.25- 0.5W of acoustic power under water at frequencies ranging from 100-1000Hz. This translates to pressure and flow rate requirements of 15-30kPa and 300- 500ml/s respectively. The MHT relies on the incorporation of discrete piezoelectric elements into a microfabricated device to produce compact high stiffness actuation at high frequencies. These piezoelectric elements used in conjunction with a piezoelectric piston enable the design of a stiff efficient electric to fluidic energy conversion mechanism with a high power density. The device relies on the DRIE fabrication of high-strength silicon membranes to form pistons with membrane tethers. A final device was built and tested and a maximum flow rate and pressure differential of 4ml/min and 350kPa were obtained. It is shown that suitable modifications will enable a future MHT device to match the pressure and flow rate requirements for underwater acoustic noise generation.
DTIC
Actuators; Ferroelectricity; Noise (Sound); Noise Generators; Single Crystals; Underwater Acoustics

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see *73 Nuclear Physics*.

20030109306 Air Force Research Lab., Edwards AFB, CA, USA
Matrix Isolation Spectroscopy of H2O2, D2O, and HDO in Solid Parahydrogen
Fajardo, Mario E.; Tam, Simon; DeRose, Michelle E.; Jan. 2003; 49 pp.; In English
Report No.(s): AD-A417671; AFRL-PR-ED-TR-2003-237; No Copyright; Avail: CASI; A03, Hardcopy

We present infrared (IR) absorption spectra over the 800-7800 cm(-1) region of cryogenic parahydrogen (pH2) solids doped with H2O, D2O and HDO molecules. Analysis of the rovibrational spectra of the isolated H20, D2O and HDO monomers reveals their existence as very slightly hindered rotors, typically showing only 2 to 5% reductions in rotational constants relative to the gas phase. The nuclear spin conversion (NSC) of metastable J = 1 ortho-H2O (oH2O) and para-D2O (pD20) molecules follow first order kinetics, with single exponential decay lifetimes at T = 2.4 K of 1900 plus or minus 100 s, and 860 plus or minus 50 s, respectively. We report without discussion some absorptions of water clusters produced during

sample annealing. We report and assign a number of absorptions to oH2-water pairs or 'complexes.' The main features of the oH2-H2O and oH2-D2O spectra are explained qualitatively by assuming a semi-rigid C2v structure with the oH2 acting as a proton donor to the O atom. Surprisingly, NSC of oH2-water complexes proceeds at very nearly the same rate as for the corresponding water monomer. We report unassigned spectra of larger (oH2)n-water clusters, and the even more surprising observation of the prolonged survival of 0H20 and pD2O molecules clustered with several oH2 molecules. We report and assign a number of water dopant-induced IR absorption features of the pH2 host, along with cooperative water-pH2 transitions in which the vibrational excitation of the pM2 solid is accompanied by a pure rotational transition of the water dopant.
DTIC

Absorption Spectra; Para Hydrogen; Solidified Gases; Solids; Infrared Spectroscopy; Matrix Theory; Deuterium; Hydrogen Peroxide

74
OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20030108423 Oak Ridge Inst. for Science and Education, TN, USA

Development of an Objective Method of Respiratory Protective Mask Lens Fogging: Data Acquisition and Image Processing Proof of Concept

Caretti, David M.; Coyne, Karen M.; Aug. 2003; 17 pp.; In English

Report No.(s): AD-A417285; ECBC-TR-333; No Copyright; Avail: CASI; A03, Hardcopy

A method that objectively related video image gray scale characteristics to Snellen visual acuity was conceptualized, developed, and evaluated in this investigation as a first step towards development of an objective measure of respirator lens fogging. Seven image processing techniques, including region of interest selection, image filtering, thresholding, removal of border objects, removal of small objects, filling of image holes, and particle detection were applied to images captured on-line with a miniature video camera through goggles with different levels of visual acuity. The image processing sequence was used to assess correlations between image particle counts and known visual acuity scores. A LABVIEW program was developed to determine Snellen visual acuity based on the presence or absence of circles from the processed images. The developed image processing and analysis application correctly identified 20120, 20150, 20170, and 201300 Snellen visual acuity conditions on a consistent basis. Following adjustments to the image thresholding techniques during image processing, program identification success improved for all acuity conditions. These findings indicate that an objective method has been established that can be used to quantify changes in visual acuity due to mask lens fogging.
DTIC

Image Processing; Fog; Data Acquisition; Goggles; Masks; Lenses

20030109083 Air Force Research Lab., Edwards AFB, CA, USA

Assessment of Multiple Scattering Errors of Laser Diffraction Instruments

Strakey, Peter A.; Mar. 17, 2003; 13 pp.; In English

Contract(s)/Grant(s): Proj-3058

Report No.(s): AD-A417435; AFRL-PR-ED-TP-2003-067; No Copyright; Avail: CASI; A03, Hardcopy

The accuracy of two commercial laser diffraction instruments was compared under conditions of multiple scattering designed to simulate the high droplet number densities encountered in liquid propellant rocket combustors. Both instruments employ correction factors to account for multiple scattering at transmission levels down to about 2%. The instrument accuracy was compared in terms of several mean moment diameters as well as the standard deviation of the measured distributions. Results show that the newer instrument with a more recently developed statistical approach to correcting for multiple scattering errors produced significantly greater accuracy than the older instrument that employs a more limited type of analytical correction scheme. The statistical correction scheme resulted in an accuracy of about +1-10% for the volume-weighted volume mean diameter, D43 down to a transmission of about 2%, while the analytical correction approach resulted in an under-estimation of D43 by as much as 45% at a transmission of 2%. With the statistical correction, reasonable accuracy was obtained at a transmission as low as 1% and was limited by the signal-to-noise ratio of the detector.
DTIC

Light Scattering; Errors; Diffraction; Laser Applications

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20030109317 Michigan Univ., Ann Arbor, MI
Local Preconditioning of the Equations of Magnetohydrodynamics and Its Numerical Applications
Leer, Bram van; Sep. 11, 2003; 6 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0158
Report No.(s): AD-A417746; AFRL-SR-AR-TR-03-0410; No Copyright; Avail: CASI; A02, Hardcopy

An algorithm for constructing the optimal local preconditioning matrix for 2-D hyperbolic systems was developed, applied to the equations of magnetogydrodynamics (MHD), and numerically tested. In addition, local preconditioners for the 1-D Navier-Stokes (N-S) equations were reviewed and the optimal N-S preconditioner was derived. (Local preconditioning reduces the local stiffness of equation systems caused by the range of time-scales of the physical processes described.) Numerical tests of the MHD preconditioner for MHD channel flow confirmed the convergence- acceleration effect and also the additional benefit of preserving solution accuracy for low-speed flow. For low-speed flow a simplified approximate preconditioner was formulated and tested. The optimal N-S preconditioner, as expected, renders the preconditioned equations unstable for certain unlikely combinations of low Mach and Reynolds numbers.
DTIC
Magnetohydrodynamics; Navier-Stokes Equation

76
SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20030108522 Texas Univ., Austin, TX
Silicon and Germanium Thin Film Chemical Vapor Deposition, Modeling and Control
Ekerdt, John G.; Apr. 2002; 4 pp.; In English
Contract(s)/Grant(s): F49620-95-1-0475; Proj-3484
Report No.(s): AD-A417307; AFRL-SR-AR-TR-03-0226; No Copyright; Avail: CASI; A01, Hardcopy

From 1995-2000, researchers at The University of Texas at Austin and the University of Wisconsin, Madison investigated and demonstrated new, intelligent manufacturing processes for growing epitaxial silicon alloy thin films that employ input from in situ optical process sensors to maintain precise control of film composition and thickness. The research team accomplished what was set forth in the original proposal. Significant progress was made in understanding the fundamental chemistry and physics of thin alloy films that affects the sensor operation and growth models, in developing and implementing state estimation and model predictive control techniques, in advancing optical sensors that can provide a complete description of the film properties, and in the design and demonstration of strained SiGe/Si and SiGeC/Si heterostructures with significant device performance enhancements over Si-based devices.
DTIC
Thin Films; Vapor Deposition; Silicon Alloys

77
PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics, 73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

20030108797 Naval Postgraduate School, Monterey, CA
An Experimental Study of a Pin-Fin Heat Exchanger
Ramthun, David; Jun. 2003; 79 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417544; No Copyright; Avail: CASI; A05, Hardcopy

A detailed experimental study has been carried out on the heat transfer and pressure drop characteristics of a compact heat

exchanger with pin fins, A modular wind- tunnel with a rectangular cross-section duct-flow area was constructed that would accommodate the heat exchanger test section with varying pin designs. The flow in the tunnel was achieved through a suction-type blower, and a leading entrance length section was added to achieve predictable flow conditions into the heat exchanger test section. The rig was comprehensively instrumented to provide all desired thermal and flow data. The results from this study provide useful empirical data to validate ongoing numerical studies of such heat exchanger designs.
DTIC
Heat Exchangers; Experimentation; Test Chambers

20030109097 Dayton Univ. Research Inst., OH
Fuel and Fuel System Materials Compatibility Test Program for A JP-8+100 Fuel Additive. Volume 1: Thermal Stability Additive Package BetzDearborn Spec Aid(Registered) 8Q462
Kalt, Dexter; Vangsness, Marlin; Wilt, Benjamin; Saliba, Susan; Dues, John; Oct. 2001; 385 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-92-C-2207; F33615-97-C-2719; Proj-3048
Report No.(s): AD-A417475; UDR-TR-97-01A; AFRL-PR-WP-TR-2000-2015; No Copyright; Avail: CASI; A17, Hardcopy

This report describes a program inaugurated to test the compatibility of aircraft fuel system materials with a JP-8 fuel containing a new thermal stability additive (TSA) package. The JP-8 fuel containing this new TSA is commonly referred to as JP-8+100. (The '+100' refers to the expected 100 deg F increase in thermal stability range of fuel containing the additive over the thermal stability range of JP- 8 fuel.) In this test report, the effects of fuel containing BetzDearborn - 8Q462 TSA (JP-8+100) in thermal and x 4 concentrations levels on over 222 different aircraft fuel systems materials are measured in comparison to the effects of JP-8 fuel on the same materials. The BetzDearborn -8Q462 fuel additive package incorporates a dispersant/detergent, a metal deactivator and an antioxidant compound which reduces the rate of oxidation and deterioration of fuel at higher temperatures. Within airframe and engine fuel systems and fuel storage and handling equipment, materials including metallics, elastomers, composites and other nonmetallics are found in contact with aviation fuel. This report describes many of these materials and physical property changes observed in these materials after thermal aging in aviation fuel containing the BetzDearborn - 8Q462 TSA package in laboratory experiments.
DTIC
JP-8; Jet Fuel, Thermal Degradation

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20030108376 Office of Naval Research, Arlington, VA
Science and Technology Text Mining: Structured Papers
Kostoff, Ronald N.; Hartley, James; Jan. 2003; 29 pp.; In English
Report No.(s): AD-A417220; No Copyright; Avail: CASI; A03, Hardcopy

Structured technical papers are full text manuscripts that contain a threshold number of canonical fields. Structured database papers are the database representations of the structured technical papers. They also contain a threshold number of canonical fields, using standardized formats where practical, but do not contain the full text. This document presents the case for instituting both the structured technical paper and the structured database paper, and shows how these documents would help accelerate the progress of science and technology.
DTIC
Technical Writing; Reports

20030108385 Naval Postgraduate School, Monterey, CA
An Implementation Methodology and Software Tool for an Entropy Based Engineering Model for Evolving Systems
Behnke, Matthew J.; Jun. 2003; 342 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417336; No Copyright; Avail: CASI; A15, Hardcopy

This thesis presents a practical method for calculating and representing entropy- based metrics for a set of bibliographic records evolving over time, in support of Dr. Michael Saboe's dissertation research which addressed the ability to measure software technology transfer. The implementation of the analysis methodology for determining the information-temperature

of evolving datasets containing bibliographic records is described. The information- temperature metric is based on information entropy and is used to relate the maximum complexity of a system to the current complexity. The implementation of the analysis methodology required using data mining techniques to prepare the datasets. Additionally, since the information-temperature metric derived from Saboe's work was a new emerging concept, the data analysis methodology had to be refined several times in order to obtain the desired results. An iterative software development paradigm was used to write the application in 3 iterations using Visual Basic. At the end of the implementation the data analysis process became systemized allowing the outlining of the steps to compute the temperature of datasets, and it is estimated that the learning curve of the analysis can be reduced by 50 percent through integration and packing of the analysis functions into a stand-alone application with an intuitive user interface.
DTIC
Software Engineering; Information Retrieval

20030108475 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD, USA
Quantitative Infrared Reference Library, Volume 1
Ditillo, John; Keiser, Christopher C.; Williams, Barry R.; Jul. 2003; 72 pp.; In English
Report No.(s): AD-A417260; ECBC-TR-297-VOL-1; No Copyright; Avail: CASI; A04, Hardcopy

The U. S. Army's Chemical Biological Applications and Risk Reduction Business Unit (CBARR) at Aberdeen Proving Ground, MD, is actively involved in Chemical Warfare Materiel (CWM) air monitoring and sample analysis for a variety of missions. These include CWM investigations, remediation of chemical disposal sites, and environmental assessments. To enhance CBARR's ability to accomplish these tasks, the organization is continually examining and evaluating new technologies in this arena. The instrument of interest for this study was the TravelIR by Sensir, Inc. It is a lightweight, portable, closed cell Fourier Transform Infrared (FTIR) Spectrometer designed to measure and collect radiation in the midinfrared band. Infrared detection is performed with a DTGS detector that operates at room temperature. The gas cell used has a 2.4-m path length, L. Data was acquired by co- adding 64 spectra at 2 cm(exp -1) resolution. The experiment was run with a series of quantitative concentrations of analyses, to include sarin (GB), distilled mustard (HD), tabun (GA), and soman (GD).
DTIC
Data Bases; Infrared Spectroscopy; Vapor Phases

20030108518 California Univ., Berkeley, CA, USA
Quantum Computing Program at the Mathematical Sciences Research Institute
Megginson, Robert; Rossi, Hugo; Sep. 5, 2003; 11 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0747; Proj-02PR12722-00
Report No.(s): AD-A417275; No Copyright; Avail: CASI; A03, Hardcopy

Through the grant for which this report is written, five workshops in quantum computing were partially funded, as well as senior researchers in mathematics, computer science, physics, and related fields, to participate in the workshops and other activities held concurrently at MSRI. This final report describes the workshops and their schedules, and details the participants funded through this grant.
DTIC
Information Transfer; Quantum Computation; Quantum Computers

20030108668 Naval Postgraduate School, Monterey, CA
Increasing the Process Capacity of a Knowledge Intensive Process Through the Use of Process Reengineering and Knowledge-Value Added Methodologies
Campbell, Errol A., Jr; Baxter, Joseph L., Jr; Jun. 2003; 115 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417344; No Copyright; Avail: CASI; A06, Hardcopy

In the increasingly dynamic environment of information technology, it has become imperative that organizations continue to seek ways to effectively capture and measure knowledge in order to survive. With the emergence of a global economy and information networks, the knowledge creating capacity within organizations has grown tremendously. As a result, organizations are now shifting their focus to management of the knowledge used in executing processes and producing products. As demand for quality products and services continues to grow, companies must now find ways to effectively manage knowledge intensive processes in order to increase overall process capacity. Through business process reengineering and the KVA methodology, this thesis will seek to identify ways in which the performance of knowledge assets can be

measured and make recommendations to improve the capacity of knowledge intensive processes, better enabling organizations to meet increased demand.
DTIC
Knowledge; Information Management

20030108906 Naval Postgraduate School, Monterey, CA
Measuring Information Gain in the Objective Force
Baird, Joseph A.; Jun. 2003; 72 pp.; In English
Report No.(s): AD-A417315; No Copyright; Avail: CASI; A04, Hardcopy

Many researchers are attempting to quantify or understand the value of information, especially for the Army as it enters its transformation. Information can be decomposed into various qualities. Three of these qualities, timeliness, accuracy, and completeness, form the basis for this thesis. This thesis uses a simulation framework developed by the author to analyze the three components of information listed above. The scenario selected is a typical vignette of an Objective Force company-sized element conducting offensive operations against threat elements. Knowledge of the threat was compromised by the presence of decoy elements as well as previously damaged or killed systems (EDA) . In this scenario the fires are initiated from standoff ranges. The initial and running assessments of the threat composition are made based on the information provided by sensors on board the unit's organic unmanned aerial vehicles (UAVs) Analysis of the simulation results helps in understanding how components of information quality affect the overall effectiveness of the force as reflected in an efficiency measure. Additionally, critical thresholds for timeliness, accuracy, and completeness of information are pinpointed to inform Objective Force decision makers.
DTIC
Military Operations; Information Theory; Pilotless Aircraft

20030109070 Maryland Univ., College Park, MD
Information Dynamics and Agent Infrastructure
Agrawala, Ashok K.; Shankar, Udaya; Larsen, Ronald; Jun. 2003; 152 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0578; DARPA ORDER-K552; Proj-TASK
Report No.(s): AD-A417453; AFRL-IF-RS-TR-2003-141; No Copyright; Avail: CASI; A08, Hardcopy

Acquisition, organization, management, retrieval, and distribution of information are fundamental purposes of digital libraries and their supporting infrastructures. Interoperable digital libraries pose particularly difficult system design issues. Interoperability research has focused largely on syntactic and semantic interoperability. In this paper, a third form of interoperability, analytic interoperability is proposed, with a framework in which to consider it. Since information is the essential commodity of interest, a comprehensive interoperability design should take into account the fundamental properties of information, including representation, composition, relationships, and dynamics. Information Dynamics considers how the nature of information can be used to achieve analytic interoperability.
DTIC
Digital Systems; Libraries

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ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20030108422 Mission Research Corp., Nashua, NH
CSIMPS: A Program for Deriving Asteroid Diameters and Albedos from IRAS data Software
Noah, Meg A.; Tedesco, Edward F.; Noah, Paul V.; Mar. 2001; 364 pp.; In English
Contract(s)/Grant(s): F19628-93-C-0028; Proj-S321
Report No.(s): AD-A417261; AFRL-VS-TR-2001-1575; No Copyright; Avail: CASI; A16, Hardcopy

The CSIMPS effort extends the work of the IMPS asteroid albedo and diameter determination by increasing the number of asteroids sampled. The IMPS processing effort was performed on 486 computer systems and was limited by disk size and memory. The CSIMPS effort removed these limitations and took advantage of more efficient processing. This report

documents the software used to determine the asteroid albedos and diameters in CSIMPS.
DTIC
Information Retrieval; Asteroids

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20030108524 Army Engineer Research and Development Center, Hanover, NH, USA
Solar Flux Initialization Schemes for Distributed Surface Energy Budget Modeling
Koenig, George G.; Tofsted, David H.; Aug. 2003; 71 pp.; In English
Report No.(s): AD-A417310; ERDC/CRREL-TR-03-13; No Copyright; Avail: CASI; A04, Hardcopy

It is a well-established fact that the state of the ground is driven in a large part by the downwelling solar and IR fluxes. Models developed to predict the state of the ground depend critically on these fluxes for initialization. When measured solar and infrared fluxes are not available they must be computed. We have compared the ground temperatures as computed by the thermal model SWOETHERM using different solar flux initialization schemes. These initialization schemes used measured solar flux values obtained during the Smart Weapons Operability Enhancement (SWOE) field programs, and calculated solar flux values from a semi-empirical model (Shapiro's model). a plane parallel model (MODTRAN), and ARL's AIM (Atmospheric Illumination Module) model. We investigated the response of the surface temperature to different solar flux initialization schemes while all other environmental parameters were held constant. We found that for clear skies all schemes resulted in nearly identical surface temperatures. For partly cloudy and cloudy skies only the AIM model can mimic the spatial variability observed with the measured solar fluxes. The Cloud Scene Simulation Model (CSSM) was used to determine the spatial variability of the clouds. The cloud distributions were then used by AIM to produce the variations of the surface solar loading. CSSM also has the capability to produce the temporal variations in the cloud fields for short periods of time. Thus, it would be possible to use CSSM and AIM to produce the temporal and spatial variations in the solar loading. Models like AIM frequently incur a large computational burden. In order to reduce the computational burden associated with AIM we have implemented several new procedures. Distributed energy budget models used to predict the state of the ground require distributed environmental parameters for initialization.
DTIC
Atmospheric Models; Energy Budgets; Flux Quantization; Infrared Radiation; Solar Flux; Solar Radiation; Cloud Cover

Subject Term Index

Personal Author Index